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What is the Extent of the Destruction in France?

What are the Plans for Reconstruction?

These questions are asked daily by engineers, contractors, manufacturers and financiers.

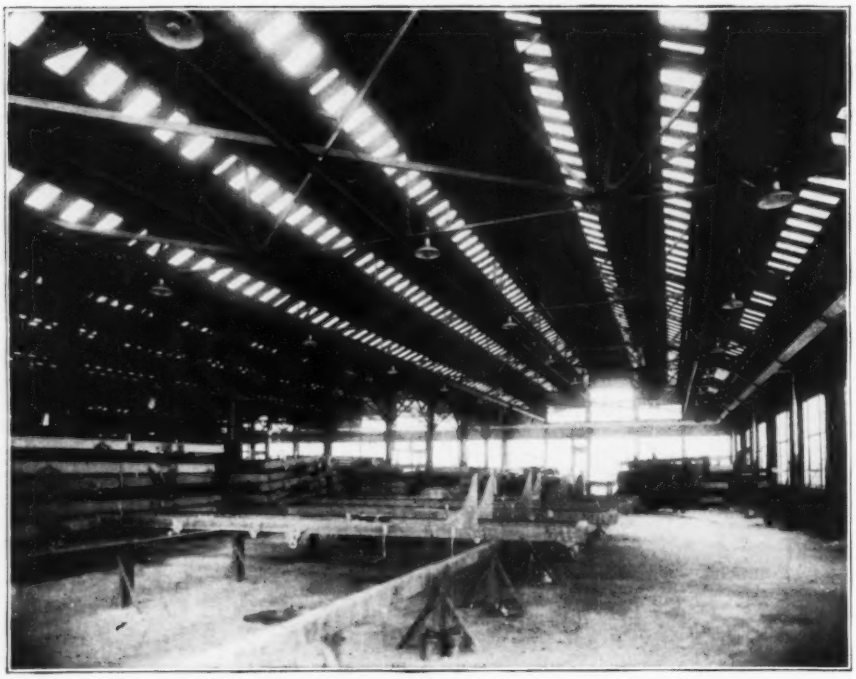
The answer to them will be found in this issue

—and it is by no less an authority than George B. Ford, the New York town-planning specialist, who has been in France since we entered the war, acting as deputy commissioner of the American Red Cross, in charge of research work. His duty has been to study these very questions of destruction and restoration, and in his work he has been backed by all the Red Cross influence and prestige.

The figures, therefore, are the best and most recent obtainable, the final tabulations for the article having been made December 20.

It is, as of the present writing, the last word as to conditions in the devastated regions of France.

The figures are of interest not merely to the readers of the Engineering News-Record, but to every student of the war, for they are the basis of the indemnity which the Germans must pay for the restoration of the invaded territory.



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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
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AND CONTRACTING

E. J. MEHREN, *Editor* — CHARLES WHITING BAKER, *Consulting Editor*

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Self-Government of Construction Camps

A NOTABLE experiment in construction camp democracy is outlined on p. 235. Camp rule ordinarily is imposed by the contractor. Instead, on the Miami flood-protection works all affairs pertaining to community life are in the hands of the camp residents. Outside of, and above the community organization, stands the Conservancy District administration, but its authority is imposed only as a beneficent influence for sound self-government. It guards democracy. This undertaking in construction camp self-government promises to create a more stable working organization, to intensify community interest and pride in the basic enterprise, and to make the workman a partner. Contractors should watch the experiment closely.

Will the Railroad Administration Discourage Building?

JUST at this time, when the country is becoming seriously worried over the business inaction which is leaving thousands of men on the street unemployed and threatening bread lines in the near future, comes a movement in the Middle West to increase freight rates on sand, gravel, stone and slag in Central Freight Association territory—the increases for two-line haul running as much as 90 per cent above rates for the same mileage for single-line-haul producers. Hearings are to be held in Chicago on Thursday of this week before C. J. Brister, chairman of the Central District Freight Traffic Committee, and it is hoped that wise counsel, taking into consideration the national interest in the large, will prevail. Freight increases on these vital building materials will still further defer the opening of a large volume of construction work, and on the renascence of the construction industry every thinking man in the United States, from the President down, is pinning his hope that disaster may be averted. The proposed increase is a simple case of loading on to the traffic more than it will bear. At present there is little tonnage in these materials, and there is sure to be less if the rates are increased. From the standpoint of the Government, therefore, which must bear railroad deficits now, it will be better to leave the rates as they are, or even to reduce them, and thus get some revenue in hauling these commodities, than to scare away prospective business by prohibitive rate increases. Moreover, even if there should be some losses at the present, or at lowered, rates, the Government can afford to bear them rather than have the country suffer the serious economic loss which will come from unemployment and its attendant evils. Anything which tends further to discourage construction work is a blow to the country. For patriotic, for sound economic, reasons rates in the Central Freight Association territory should not be disturbed.

Not Only By Their Work Shall Ye Know Them

ENGINEERS have fondly believed that most of the problems that come under that much overworked word "reconstruction," as currently used, are within their province. Certainly, every day is proving that industry and labor will loom larger in the readjustment period than anything else, and who has a more intimate knowledge of industrial conditions and labor difficulties than the engineer? It is, then, disappointing to find in Governor Smith's New York reconstruction commission of 36 men and women only one engineer, and he a man of intense specialization. Business men have nine representatives; bankers, eight; lawyers, four; sociological experts, three, and labor, two. Editors, doctors, farmers, and engineers have one each; the rest are difficult to classify. The distribution is significant of current opinion, for all published comments agree that the Governor has carefully selected an able and representative group. The engineer is in part responsible for this attitude. What a man thinks and does may make little impress on the world at large, unless the world is told of his thoughts and actions. So it is with the engineering profession. Until it becomes vocal, through its individuals and organized societies, the world will consider it a group of master artisans, quite capable of solving the material problems of construction and manufacture and distribution, but subservient to the banker, the business man, and the lawyer in the great science of living.

Little Room for American Endeavor in France

IN THE issue of Jan. 2 *Engineering News-Record* answered the question frequently asked, "Are American engineers and contractors wanted in France and Belgium?" The answer, viewing conditions as they are now, was, emphatically, "No." Following up that answer we are fortunate in being able to present in this issue two articles that go into the French situation more fully—that give the facts as to the extent of the destruction, and discuss the plans for rehabilitation. Mr. Ford, the author of the longer article, has had, in his capacity as head of research for the American Red Cross, exceptional facilities for ascertaining the facts. There could be no higher authority. Mr. Williams, oc-

cupying the position of commercial attaché of the American embassy in France, gets a somewhat different light on the situation. Looking into the spirit of those who are planning the rehabilitation, he reports a disposition to abandon ruins which have been replaced by properties elsewhere in France. On one point he is decidedly specific—that the prospects for getting business for Americans from the devastated zone are not encouraging. Moreover, this idea is conveyed, too, by Mr. Ford's article, when he reviews the ability of France to supply her own building materials. Altogether, it seems advisable for American engineers, contractors and manufacturers who want engagements or business in foreign lands to look elsewhere than in France. While *Engineering News-Record* has not been able to get equally full information regarding Belgium, such word as has come to hand indicates conditions identical with those of France, so far as prospects for American endeavor are concerned.

Have the Railways Used the Engineering Profession Well?

THE engineering profession may justly claim to be the creator of the railway. All its structures and machinery existed in the engineer's brain before they assumed concrete form. Yet there is probably not an industry which has so signally failed to give the engineer proper position and compensation.

The low pay of engineers in railway service has been long notorious. It was prominently brought forward in the statistics of the earnings of engineers in various occupations collected by the American Society of Civil Engineers a few years ago. Elsewhere in this issue detailed figures are given for railway engineers' pay, compiled from the Government's official statistics. The showing is one that may well command the attention of the profession and ought to awaken public interest.

For it is not difficult to establish a relation between the failure of the railways properly to use and reward the engineer and their failure to earn the profits which they should. It is well to recall that famous definition of an engineer as "a man who makes a dollar earn the most interest." That definition was the result of a noted engineer's practical experience in railway work.

There is no claim here that engineers can perform miracles. They cannot prevent the great increase in wage rates and the eight-hour day from producing a huge increase in railway operating expenses. The engineers and draftsmen who are kept doing mere routine work can do very little, admittedly, to help the railways out of the financial slough in which they now lie. But there are engineers in railway service who with proper authority and funds could do a great deal to save money for the railways.

Director General Hines has just announced that $491,000,000 will be spent this year on additions and betterments. This work must be done under the direction of engineers. Has all this work received thorough investigation by competent engineers, so as to insure maximum economy? That the work has been passed on by a board of engineers is doubtless true; but every experienced construction man knows that time and money spent in preliminary investigations will often result in saving ten times the amount in the cost of carrying out the work.

There is no doubt that in many railway companies an engineering organization has been built up which has done able and conscientious work, notwithstanding the handicap of inadequate pay; but it is not fair to the men who render this service nor safe to the railway's financial position to continue to pay less for good service than it is worth. The railway engineer has as good a right to a living wage as the blacksmith or the baggageman and as good a claim to a return on his investment in education and experience.

Sanity In Planning Passenger Terminals

HAVE we arrived at any degree of sanity in the consideration of railway terminal problems? The action at Cleveland, in endorsing by popular vote the railway-terminal project described elsewhere in this issue, puts the problem squarely, not only before the engineers who have dealt with the Cleveland situation, but before the whole profession. The question concerns the larger elements involved in terminal planning, such as location, desirability of centralizing all roads in one station, etc. Moreover, the situation makes opportune a discussion of the justification for exceedingly heavy terminal expenditures.

Briefly, the situation at Cleveland is this: For years there has been agitation for a new station on the lake front, resulting finally in a well matured plan of making the new station fit in with a civic-center development. Then, as out of a clear sky, comes a proposal to scrap these plans of long consideration and to place a terminal to accommodate all roads, and electric interurbans also, in a station adjoining the Public Square. With a hurrah, Cleveland's citizens drop the former plan and approve the new one—despite the declared disapproval of the Cleveland Engineering Society, and the condemnatory import of the report by Col. Bion J. Arnold, engineer to the Chamber of Commerce, on the terminal problem.

Apparently, the points that won the day were the proximity to the Public Square and the union of all railroads and interurbans under one roof. Yet are not these the very reasons why sound planners for a city's future should reject the scheme? The Public Square is already the point of maximum congestion in Cleveland—yet the new scheme would concentrate still more people there. Again, is not the unification of all passenger terminals a fetish too long pursued by terminal planners? It, too, tends toward more severe rather than lessened congestion.

"Convenience to the public demands a single station," is the answering cry. Convenience to how many of the public? For what percentage of passengers is this accommodation allowed to work all manner of inconvenience to every other passenger and to every citizen coming near the congestion-creating union station?

Is it not time to find out how many passengers transfer from road to road, and to balance against the benefit to these strangers the rights of all other travelers and of the city and its inhabitants as a whole?

Finally, is this not the time to challenge the whole idea of $20,000,000 and $40,000,000 and $50,000,000

passenger-terminal projects? Who has studied the operating costs of a number of modest stations, as against one huge central terminal? Who has frankly faced the added capital cost of new lines (property costs and all), to reach the central point? Who has data to show that from the railroads' point of view the huge central station is a profitable business venture?

Rank heresy—so will this be branded. But there is urgent need of new thinking on the whole question of city railroad terminals. There needs to be a new appraisal of all the factors, there needs to be a frank breaking away from previous methods of terminal thought. Above all, there needs to be a spade-calling era in which there will be no mincing of words as to the business aspect of large union stations. If a city demands a great monumental terminal—which may be a monumental white elephant, financially, in an operating way and even to the city, on account of the creation of congestion—let the truth be known, and then, if the city demands this addition to its architectural beauties in order to tickle its civic pride, let it assume the burdens which the plan involves over and above those of a sound business solution of the problem.

If this be heresy, we are glad to be heretical.

Why Not Use Machinery for Snow Removal at Railway Terminals?

AN IMPENDING emergency problem which is likely to be presented to railway officials on short notice at this season is that of handling heavy snow at city terminals and yards. As this is a recurrent problem, it should be studied jointly, and evidently in advance, by the engineering, operating and mechanical departments. Speaking generally, however, there seems to be a continual state of unpreparedness, except for reliance upon old and inadequate methods. Consequently, when heavy snowfalls occur, terminals are likely to be blocked and traffic interrupted, or even stopped in exceptional cases, although on the open road trains may be able to operate with some degree of regularity.

Machinery for snow handling at terminals has not received much attention in the past, but present labor conditions should be an incentive to active consideration of the possibilities of mechanical devices. Manpower is the main factor in the old-time methods, and in former years an abundance of temporary labor has been available. The serious shortage of such labor in the winter of 1917-18 showed the unwisdom of relying continually upon man-power.

Moreover, manual labor is largely ineffective, even when the supply is ample, a fact made evident in some cases last winter. When large terminals were nearly or entirely closed, owing to deep snow, the measures adopted consisted almost entirely of the use of large gangs of shovelers. Crowds of men were to be seen, each carrying his shovelful of snow for some considerable distance to a dumping point between or beyond the tracks, and then returning for another load. Progress was necessarily slow on account of the storm and cold, the heavy clothing of the men, and because they had to tramp through snow and across numerous tracks and obstructions.

Steam-heated pits to receive the snow, with connections to city sewers, are provided in the Chicago station yard of the Chicago & Northwestern Ry., but these apparently are not sufficient for the need. As a rule, the snow is piled in some more or less convenient place where it has to be loaded into cars for removal.

That snow-handling machines would be required only occasionally, and for short periods, has been urged as one reason for failure to develop them. But when snow removal is necessary it is urgent, and the needed machines come into the same category as snow plows, snow fences and other special equipment.

A type of machine that suggests itself consists of a wide continuous chain or belt excavator, carried on an inclined pivoted boom attached to the forward end of a car, and delivering the snow to a horizontal conveyor extended back to load cars placed between the excavator and the propelling locomotive. A frame carried by wheels riding on the track rails would support the outboard end of the boom and would be fitted with flangers to clear the rail heads and so prevent derailment. Flangers in the shape of revolving wire brushes might be less liable to injury at frogs and switches than ordinary flanger blades.

Pilot plows and flanger cars may suffice to keep tracks open during a moderate snowfall, but when a heavy fall buries the tracks these devices become largely ineffective. Bucking plows can rarely be used to advantage at terminal yards, as they cannot be operated at the necessary speed, and there is likelihood of derailment on the numerous frogs and switches, especially when these are clogged with ice and snow. Rotary plows are not often available, and for effective work they need a greater depth of snow than is usually encountered near cities, while throwing the snow to a considerable distance by such a machine might cause greater trouble than the snow blockade.

Freight yards constitute a specially difficult problem, since, with snow drifted under long lines of cars, it becomes almost impossible to get the cars out. If attempt is made to move them with a locomotive there is likelihood of pulling out drawbars, or of derailment by wheels riding up on the snow packed in front of them. Shoveling seems to be the only method practicable for such cases, although it is likely that even this problem might be solved in some simple manner if it were given careful study. Spreader cars may be useful in clearing yard entrances and unoccupied tracks.

Blocked switches cause serious delay where frequent train movements are involved, and both gas and electric heaters for these moving parts have been used to a limited extent. Such installations on the New York Central Railroad were noted in *Engineering News-Record* of Dec. 19, 1918, p. 1120. The total cost, including purchase price and operating cost, is probably negligible, considering the very important result of keeping the tracks open and reducing detention of trains.

Two months of winter are still to be faced on a large part of our railway system, so that there is opportunity as well as reason for the study of this important problem. Surely, the present methods of grappling with it indicate clearly a failure to apply to it the same sort of analytical and constructive study that is generally associated with problems of traffic maintenance.

The Facts on the Devastation and the Present Reconstruction Efforts in France

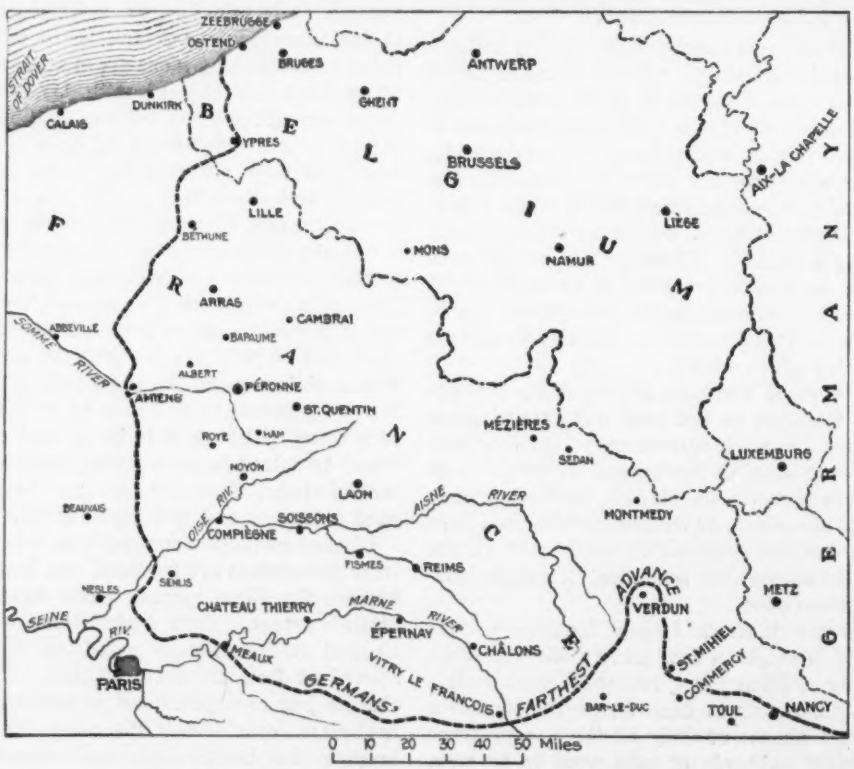
Detailed Summary of the Extent and Character of the Destruction, With a Complete Account to Date of the Measures, Official and Otherwise, to Reëstablish the Invaded Regions

By George B. Ford

Deputy Commissioner of the American Red Cross, Paris, in Charge of Research Work; Formerly Consulting Specialist on Town-Planning, New York City

Further light on the situation in France will be found in the news section of this issue, in the form of a most illuminating interview with Pierce C. Williams, commerical attaché of the American embassy in Paris, who has just returned from France. He answers more specifically the questions regarding trade possibilities and the financial difficulties involved in the rehabilitation work.—Editor.

SO STUPENDOUS is the destruction in the devastated regions of France that no one can begin to realize what it means. It is only by traveling day after day in an automobile through village after village and town after town, often where nothing is standing erect more than a few feet above the ground, that one can begin to have any conception of its enormousness. The destruction varies much in its completeness. Often where there has been only minor shell-fire, one finds just the roofs and the windows gone. Or again, in towns like Vaux or Suippes, that have been through a terrific bombardment, one hardly appreciates that he is passing what was formerly a village, so thoroughly churned up are the buildings and the ground.



MAP SHOWS DEVASTATED REGION OF FRANCE

In general, where there has been a rapid advance or retreat there has been very little destruction, but where the opposing armies have faced each other for a considerable length of time in one spot the destruction is almost always intense and often complete. For example, in the great German drive of September, 1914, very little destruction was caused, but at the places where the hardest fighting occurred, at the turning of the battle of the Marne—that is, along by Meaux, Sezanne, Vitry-le-François and Revigny—the destruction is quite complete, but only for a narrow fringe where the battle was hardest. The same thing is true along the battlefronts in the Somme and the Aisne, where the hardest fighting took place; there is complete destruction extending over a belt rarely over 10 or 12 miles wide at most.

The other kind of destruction is the wilful devastation by the retreating enemy as in the Somme, the Oise and the Aisne in the spring of 1917. In the first part of the retreat only minor destruction took place, but later he had had time to do a thorough piece of work, with the result that a wide belt east of Peronne, Ham and Noyon was completely destroyed. The same was true in the retreat of the autumn of 1918. It is interesting to see how the destruction developed. For instance, in September, 1914, at the time of the great German advance and during the battle of the Marne, there was comparatively little destruction in the North and in Champagne. It is only when we get down to the Marne, Meuse, Meurthe-et-Moselle and Vosges, that we find the places of any great destruction. In the Marne, 258 communes were damaged, including a total of 3500 buildings entirely destroyed and nearly 12,000 partly destroyed, while 40 communes remained on the German side of the lines. In the Meuse, 59 communes were damaged, with about 1800

buildings completely destroyed and nearly 700 partly destroyed, with 236 communes remaining in the hands of the Germans. In the Vosges, 53 communes were damaged, with a total of 1256 buildings completely destroyed and nearly 2000 partly destroyed, with 25 communes remaining in the hands of the Germans. In the Marne and the Meuse most of the destruction took place during the battle of the Marne, along both sides of the lines, where the fighting was heaviest. It started in at Meaux and did not get really serious until near Sezanne. Then, in the farming villages south of Chalons-sur-Marne and west of Vitry-le-François running up past Revigny and Bar-le-Duc and Verdun and down to St. Mihiel and Commercy, the destruction by shell-fire is intense. This makes a belt about 150 miles long where the destroyed area is anywhere from five to ten miles wide.

AGRICULTURAL MACHINERY WRECKED BY DYNAMITE

Around Nancy there is comparatively little destruction, but north and east of Nancy the destruction is again very serious, almost all by shell fire, including cities like Lunéville, Gerbevillier (which was systematically burned) part of Ramberviller, St. Dié, etc., down to the border of Alsace, where the buildings, especially in the larger town of Thann, are largely destroyed.

In addition, there were various cities behind the lines which were within the range of German guns and in which quite a little destruction has been caused. This is especially true of Belfort, also of Bar-le-Duc, and to a less degree of Nancy.

During the German retreat of March, 1917, in battles of the Somme, the Aisne and the Oise, in the first part of the retreat in the Oise and the Aisne, they destroyed the buildings only partially, usually by burning, so that in most towns the exterior walls and partitions are standing in many buildings; they could be repaired by putting on roofs and putting in windows and doors, but east of the line extending from Noyon to Ham and north of a line extending due west from Ham, the Germans had time to burn systematically and blow up almost all of the villages, with the result that destruction was complete, and in some cases one can ride through a village without knowing it.

Little Is Left of Many Towns

At the time of the German advance in March and in May, 1918, they came within shelling and bombing range of a number of large cities and towns, so that today little is left of Hazebrouck, Béthune, Arras, Albert, Compiègne and Rheims, and severe destruction is seen in Amiens, Clermont, Beauvais, Senlis, Épernay, Chalons, Bar-le-Duc, Toul and Nancy.

In the German retreat, during the last four months in the Somme, Aisne and Oise, a large area southwest of Ham, which before had only been partially destroyed, is now found to be completely destroyed, and cities like Noyon, Ham, Guiscard, Nesle, Roye, Soissons, Dormans and Fismes are almost completely ruined. The devastation in the region around Peronne and Bapaume was so severe before that very little more happened to them.

During the last four months of the war the allies won back from Germany nearly 8050 square miles of land in France, or an area nearly as large as the States of Delaware, Connecticut and Rhode Island. This is nearly 3% of the total area of France, includes about 2000 communes, with a total population before the war of some 2,500,000.

The German advance in March and May of 1918 covered a little over 2300 square miles. The German retreat of March, 1917, covered about 1550 square miles. This was about 80 miles long and had a maximum depth of about 25 miles, making about 0.5% of the total area of France, and including about 500 communes with a total population of about 325,000.

Four years ago the total invaded area exceeded 15,000 square miles, or something over 5% of the area of France, including over 3500 communes with a total population of over 4,000,000, embracing the best manufacturing district and the best farming country of France. This area is larger than Maryland and Delaware combined, or as large as Massachusetts, Rhode Island and Connecticut, or one-third as large as Pennsylvania.

The devastated area in France covers approximately 6000 square miles in all, about 2% of France, with a total population of nearly 2,000,000 people. This is about equal to the area of Connecticut and Rhode Island.

The area reconquered in Alsace until the last phase of the war equalled about 450 square miles, or about two-fifths the area of Rhode Island. Outside of the

half-destroyed town of Thann there was almost no destruction. In all there are about 6000 square miles in Alsace-Lorraine, with 1,874,014 inhabitants in 1910.

Alsace-Lorraine had over 1,000,000 acres of forests. Its chief crops were hay and potatoes. It produced 3,538,722 tons of coal, 20,083,238 tons of iron ore, 102,644 tons of potash. The potash deposits are estimated at 2,000,000,000 tons. It made 2,908,230 tons of pig

EVEN THE TREES AROUND THE RUINED CHATEAU WERE DESTROYED

iron and 1,444,953 tons of steel. There were 5691 textile plants, employing 80,423 persons. These included 1,900,000 cotton spindles.

Belgium has suffered at least $2,000,000,000 worth of destruction in all and there are $2,000,000,000 worth of thefts made and taxes imposed by Germany. Of this amount $1,150,000,000 is loss of machinery, tools and stock. Some 150,000 working men have been taken into Germany.

Belgium covers about 12,000 square miles and had 7,423,784 inhabitants before the war. It had nearly 1,500,000 acres of forest. It produced annually 3,253,067 tons of potatoes, 1,702,535 tons of sugar beets and great quantities of oats, rye and wheat. A total of 22,972,000 tons of coal a year were mined by 145,670 miners and 2,301,290 tons of pig iron were made. There were 1,492,258 cotton spindles in use. In 1913 the Government revenue was $160,000,000 and the total debt $750,000,000.

French Reports on Destruction

On July 24, 1917, the French Ministry of the Interior prepared a report on the destruction, as closely as it could be determined, on the French side of the lines. This report followed one made at the end of May, 1916. The later report covered 1223 communes in 11 departments, whereas the earlier report covered 754 communes in 10 departments. In all these communes there has been more or less destruction, and this number does not include 450 communes that were still too near the front to make it possible to make a complete survey of conditions. The total number of communes freed from the enemy by the advance of the spring of 1917 was 499, thereby reducing the total number of communes resting in the hands of the Germans from 2554 to 2055, all of which are now freed. Most of these communes are strictly agricultural, so that the destruction hits particularly hard the richest farming area of France.

It was reckoned that in the 1223 communes reported on a year ago the number of buildings damaged was 102,697, as compared with 46,263 in May, 1916, and of these the statistics show that in 1917 50,756 of the buildings were completely destroyed. Of the latter, 18,824 were in the Somme and 12,701 in the Aisne.

The hasty investigation since the signing of the armistice shows that *the total destruction in France has been quintupled, with something like 500,000 buildings damaged, of which at least 250,000 are completely destroyed.*

The average cost of these buildings before the war was nearly $5000. As the present cost of a building is about 2½ times greater than it was then, we can say that the total *destruction in France of the buildings alone is today over $6,000,000,000* as estimated by the Government engineers and $4,000,000,000 as estimated by the architects' and contractors' associations.

The total cost of repairing and replacing the *used up or destroyed public works is estimated at about $2,000,000,000* of which $200,000,000 is for the Nord R.R., $150,000,000 for the Est, and $50,000,000 for the other railroads. About $200,000,000 will cover the rebuilding of the canals. The Nord R.R. alone has lost 1731 bridges and 338 stations.

In 1917 there were 527 communes in which over half of the buildings had been completely destroyed. This number has probably reached today something like 1500 communes in all. In 1917 in 400 communes over 80% of the buildings had been damaged, and this proportion probably reaches today over 1000 communes. In the summer of 1917 there were counted over 435 town halls destroyed, 600 schools, 472 churches and 377 other public buildings, and it can be safely said that over 1200 churches are destroyed and over 1500 schools.

Industrial Means of Support of 500,000 Gone

In 1917 were counted over 414 industrial plants destroyed, which supported 105,000 persons. It can probably be said today that there are in all over 1000 plants destroyed, supporting at least 500,000.

On Oct. 25, 1916, a report was made by the Minister of the Interior on the building materials destroyed that would have to be replaced. It was made for 790 communes, or for 41,223 buildings totally or approximately destroyed, and it comprises the destruction of 1,700,000 cu.yd. of stone masonry, 600,000 cu.yd. of brick masonry, 300,000 tons of lime, etc. The largest part of this destruction was in the Pas-de-Calais and the next larger in the Meurthe-et-Moselle. It also showed the destruction of 200,000,000 ft. of lumber, 33,000 tons of iron and steel, 91,000,000 roof tiles and 32,000,000 roofing slates. The total destruction today is probably at least five times as large—which gives a slight idea of the problem before France in reëstablishing this area.

The total loss of furniture and furnishings today, exclusive of machinery, amounts to at least $2,225,000,000 as estimated by the Government engineers and over $1,000,000,000 as estimated by insurance companies.

According to a report made by the *Office de Reconstitution Agricole* to the Minister of Liberated Regions in May, 1918, it was reckoned that at that time about 8000 square miles of French land was in the hand of the Germans. About three-quarters of that area is

tillable and a large proportion of the rest is good for hay or pasturage. This is some of the very best and richest agricultural land in Europe. The 10 invaded and liberated departments produced in 1913 nearly $400,000,000 worth of crops. The average yield of this land is about 32 bushels of wheat to the acre. In the Marne this drops down to about 22 bushels to the acre, and in the Meuse and Meurthe-et-Moselle to about 17 bushels. These regions constitute about 15% of the total tillable area of France, and the crops constitute about 20% of the total for France. The agricultural population here is about 807,000, or about 10% of the working agricultural population of France. It is estimated that *250,000 acres were rendered uncultivable by the war.*

Damage to Farms and Their Contents

In this region there are about 250,000 farms, of which 110,000 are less than 2½ acres apiece and about 100,000 between 2½ and 25 acres. About 26,000 are between 25 acres and 100 acres, and 5500 farms are over 100 acres in size. A great many of these farms belong to people who are working in factories, which accounts for there being such a large proportion of small farms. This is quite unusual in France. The capital investment in these farms is reckoned at $400,000,000, or an average of $1600 per farm. The value of farms has more than doubled in France since the beginning of the war, so the total value of these farms today stands nearer $800,000,000 or $3200 each, without counting the value of the buildings.

To get an idea of the number of agricultural implements that would be needed, a list was made by the Government engineer in charge which showed that to replace the losses they would need about 51,000 sidehill plows, 33,000 other plows, 56,000 cultivators, 30,000 mowing machines, 115,000 farm wagons, 88,000 harrows, 50,000 rollers, 48,000 hoes, 36,000 seed drills, 13,000 fertilizers, 16,000 beet extractors, 21,000 winnowing machines, 18,000 horse rakes, 32,000 reapers and binders, 53,000 root cutters, etc.

With regard to the cattle lost, it is very hard to get at the exact figures, but in these departments in 1913 there were 607,000 horses, whereas in 1915 there were only 242,000, showing a loss of 60%. Of cattle of all kinds there was a loss of 850,000, or 55%, and of pigs the loss was 380,000, or about 55%. The loss in wheat amounts to about 1,300,000 acres and in hay to about 850,000 acres. *The total damage to the soil, to livestock, crops, forests, tools, etc., is estimated at $2,000,000,000.*

Before the war, France used 59,407,000 tons of coal a year, with 9,166,000 tons more in coke equivalent. Of this France produced about 40,844,000 tons and 5,357,000 tons of coke equivalent. Of the deficiency 27,389,000 tons of coal came from the Valenciennes basin. In all, something over 70% of the total coal supply of France came from the invaded regions, and very much the best quality of coal at that. About 140,000 men were employed in the mines in the invaded regions, out of 203,208 coal miners for all of France. Three-quarters of a million persons were largely dependent on the coal mines. Over $200,000,000 worth of machinery has probably been destroyed.

Before the war the total production of iron ore in France was about 21,918,000 tons, of which 19,629,000 tons came from the Briey and Longwy basins in the Meurthe-et-Moselle; that is, 90% of the total, of which 16,500,000 tons was in the hands of the Germans. The miners who were employed in these invaded mines, with their families, represent at least 150,000 persons out of employment. It is interesting to know that just before the war the total of German iron production was 35,941,000 tons. In the United States it was 63,000,000 tons. Over $500,000,000 worth of machinery has been destroyed, including that of steel and iron mills. Before the war 3,000,000 tons of steel were manufactured in the region invaded by Germany, out of 4,686,000 tons for all of France, or nearly 65%. The same percentage holds for cast iron. The effect of the German invasion on other metals has not been so serious, as most of them come from the interior of France.

The chemical industries have suffered very little from the invasion, proportionally.

The textile industry consisted before the war of about 7,530,000 cotton spindles throughout France, of which 4,500,000 were in the region invaded by Germany and of which almost all were either destroyed or carried back into Germany and France. Out of 2,365,000 wool spindles 2,000,000 were in the invaded districts. Out of 550,000 linen spindles, 500,000 were in the invaded regions and destroyed or removed. The same is true of looms, of which there were 140,000 in France, and over 81,000 of these were in the invaded districts. Over $120,000,000 worth of machinery has been wrecked.

Of 210 sugar refineries in France 140 were destroyed by the Germans, and of 3000 brush factories, 2000 were destroyed. Over $25,000,000 worth of machinery has been ruined. Electric power stations, totaling 300,000 kw. have been destroyed, with an equipment loss of $50,000,000. From breweries over $25,000,000, from machine shops $100,000,000 and from foundries, etc. $60,000,000 worth of machinery is gone. None of these damages includes land or buildings. Furthermore, almost all of this machinery *costs three times as much* to replace today so that it can safely be said that *$4,000,-*

THE FARMER'S CART WAS RUINED

000,000 worth of machinery will be needed to replace that destroyed or carried away. This includes the stock and raw materials damaged and damage done to the mines.

Injury to Cement Plants and Forests

Before the war France manufactured 3,000,000 tons of cement a year. In February, 1918, it was manufacturing only 400,000 tons, which amount since increased and has later diminished through the difficulty of obtaining coal. A large proportion of this was in the invaded departments.

The Service of Forests and Water-Supply in the Department of Agriculture estimates that 1,200,000 acres of forest land have been destroyed by the enemy. Over half of this wooded area belongs to the Government or to the communes. There were about 750,000 acres of woodland within the war zone which have not been cared for since the beginning of the war, and which have thereby lost a great deal of their value. We can count on the complete loss of at least one-quarter of this latter area, or a total loss of nearly 1,500,000 acres. Therefore France has lost nearly 10% of its lumber and 6½% of its firewood. The war has destroyed over two billion board feet of lumber.

Before the war there were about 750,000 men in the various building trades, of whom about 75,000 were located in the invaded departments. The total building done throughout France before the war in any one year was less than 7% of the building that would have to be done to replace what has been destroyed in the invaded departments. Therefore, if no building were to be done elsewhere in France after the war, and reckoning that 500,000 of the building tradesmen of France would be available to work in the devastated regions, it would take over 20 years to rebuild them.

The total damage in the north of France, including that to buildings, agriculture, industry and public works, is estimated at 64,500,000,000 francs, or about $13,000,000,000. These were the figures reported by M. Dubois for the Committee on Budget in the Chamber of Deputies in December, 1918. We have checked most of these figures from various official and private sources, and believe they are somewhat high.

What the French Government Has Done to Reëstablish the Liberated Regions

Early in December, 1914, the French Government, then sitting in Bordeaux, appropriated $600,000 for the immediate assistance of the invaded communes of the Marne. In December, 1914, Parliament incorporated in the budget for 1915 an appropriation of $60,000,000 for the use of the Ministry of the Interior in meeting the most urgent needs of the inhabitants of the region. On Aug. 5, 1918, the Minister of Liberated Regions reported to Parliament that out of this sum, $36,000,000 had been expended, divided by departments as follows: Marne, $3,000,000; Somme, $2,000,000; Oise, $1,500,000; Meurthe-et-Moselle, $1,400,000; the Aisne, $1,300,000; Meuse, $1,000,000; Vosges, $500,000; Seine-et-Marne, $500,000; Nord, $500,000; general supplies, $2,500,000. To this sum should be added $6,000,000 spent to drain out the mines, another $6,000,000 for stocking up with building, industrial and agricultural materials.

In 1916 the Minister of the Interior started a special service to prepare for reconstruction, and in May, 1916, the President of the council created the Interministerial Committee, whose function it was to coördinate the work of reconstruction undertaken by the various ministries. In January, 1915, the Chamber of Deputies adopted a bill known as the *Loi Cordunet* which provides compulsory city planning for the whole of France, particularly the devastated regions. This is not yet law. In September, 1916, the Minister of the Interior asked the *préfets* of the devastated departments to make city plans for their destroyed towns.

Early in 1917 the Minister of the Interior established a fully organized service for handling the interests of the refugees in the devastated regions, and the technical service was organized for repairing damaged buildings and for the manufacturing of demountable barracks. Meanwhile, arrangements were made for giving advances to returning refugees, up to a certain proportion of the eventual indemnity, which they will receive from the state for their damages when the war indemnity bill is passed.

In August, 1917, Parliament passed two laws granting appropriations of $20,000,000 each to the Ministry of Commerce and the Ministry of Agriculture, to make purchases for industrial and agricultural reconstruction. In the autumn of 1917 a special service for reconstruction and for putting the soil back into shape was created in the Ministry of Public Works.

A New Ministry Created

In November, 1917, it became so apparent that there must be a single head and control for all this civilian work in the war zone that the Government created the Ministry of Blockade and the Liberated Regions, of which M. Lebrun is the head. Aside from the work in connection with the blockade, the work in the liberated regions is divided into four main services in the ministry: (1) A general service for the reorganization of general local life, for payment of war indemnities and the coördination of public and private relief agencies, under M. Bluzet; (2) a technical service of reconstruction and putting the soil back into a state for use, under Colonel Suquet; (3) an office of agricultural reconstitution, under M. le Seigneur; (4) an office of industrial reconstitution, under M. de Boisson. Thus, all the different functions of the French Government which have to do with the invaded regions are brought together under one head. Since Nov. 15, 1918, they are at last under one roof at 223 Rue St. Honoré, in Paris.

To the agricultural office was voted a credit of $60,000,000 and a revolving fund of $20,000,000 for its work. To the industrial office was voted a credit of $50,000,000 and a revolving fund of $20,000,000.

The Interministerial Committee continues in an advisory capacity. There is also the parliamentary committee, composed of all the senators and deputies from the invaded departments. This committee keeps a general oversight and legislative and budgetary control over all the Government action for the refugees and their property.

Since the signing of the armistice, the Minister of Armament, with M. Loucheur as minister, has become a Ministry of Industrial Reconstitution, for changing

the munitions plants to peace manufacturing, and absorbing the Office of Industrial Reconstitution from the Ministry of Liberated Regions. A credit of $400,000,000 has been granted to this new ministry.

The Ministry of Liberated Regions has created two new special associates to the minister, a *commissaire général* to act as liaison officer with the other ministries, and a *controleur général* for accounting and follow-up.

In general, the government has (1) been giving immediate aid and relief to the returning refugees, clothing them, feeding them, giving them shelter and the necessary utensils and tools, and (2) it has been helping them reëstablish themselves permanently by giving them advances on the indemnities which they will probably receive from the Government, and helping them start the reconstitution of their own livelihood, and helping them to construct the necessary buildings. Mention has already been made of the $34,000,000 distributed for immediate aid, out of a total credit of $60,000,000 voted in December, 1916.

Up to Mar. 31, 1918, $28,000,000 had been advanced to returning refugees against their eventual indemnity, to help them get started in reëstablishing themselves. In addition, about $10,000,000 has been advanced against industrial indemnity. Besides these sums, $12,000,000 has been advanced to the farmers to help them start recultivation of abandoned farm land, out of a total credit available of $3,000,000 granted under what is known as the *Compère Morel Loi* for aiding agriculture in France.

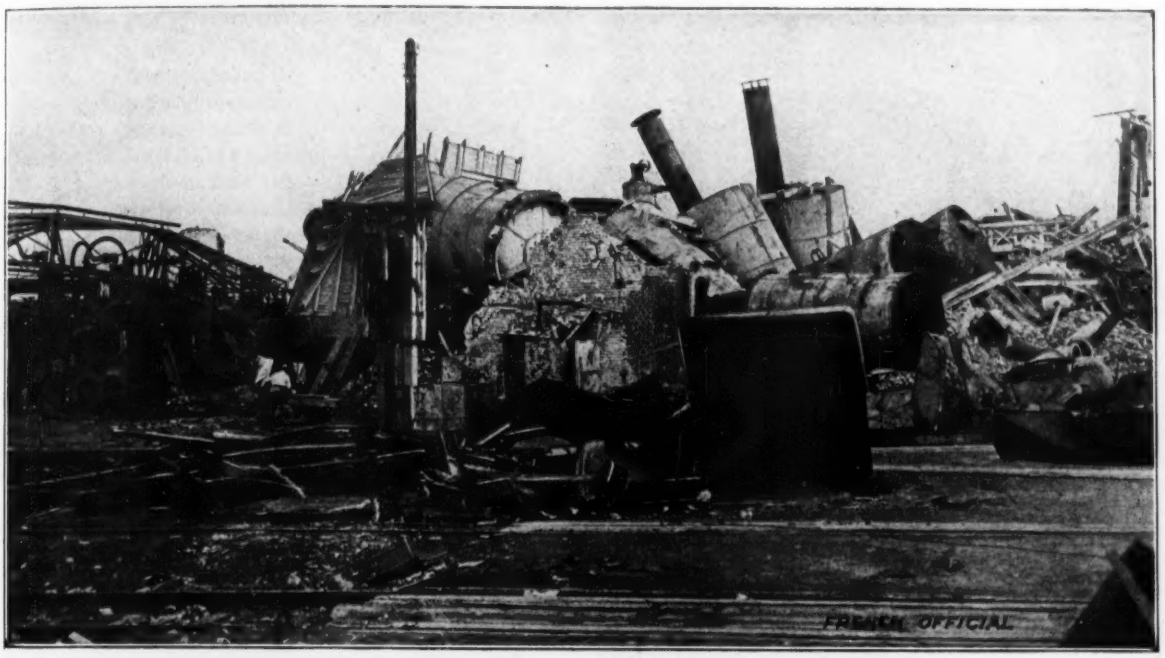
The Government bill providing indemnities in full to those who have suffered full damage was voted by the Chamber of Deputies in 1916. In a somewhat changed form it was voted unanimously by the Senate early in 1918, and at present the version as voted by the Senate is being considered in the Chamber of Deputies, only one point remaining to be settled, and that is whether the reëstablishment of a business or industry or a home within the same town shall be obligatory or optional, if the damaged person would touch the full indemnity that will be paid to him.

In general, everyone has agreed that every kind of damage should be paid in full, including any extra expenses caused by the increased cost of living, materials and labor. It is expected that this bill will become law within a few weeks. Meanwhile, the Minister of Liberated Regions has been making advances as above noted to damaged people who wish to reëstablish their property right away, to the extent of paying them in cash or in kind up to 90% of the appraised value of the property damaged, on the basis of values as they were at the beginning of the war. As the cost of building has more than doubled since that time and almost everything has gone up proportionately, this means that the actual advance is only about two-fifths of what it costs to replace the buildings today.

On Dec. 12, 1918, a law went into effect providing that the state could requisition the piled-up ruins of buildings to work over for new buildings.

The technical service of reconstruction in the Ministry of Liberated Regions has for the past two years been doing repair work, wherever called for in the devastated regions, working through the local engineers in chief and the Minister of Public Works. It had at work in the Somme, the Aisne, and the Oise, after the German retreat in the spring of 1917, about 1000 German prisoners and 1000 civilians, working under civilian contractors.

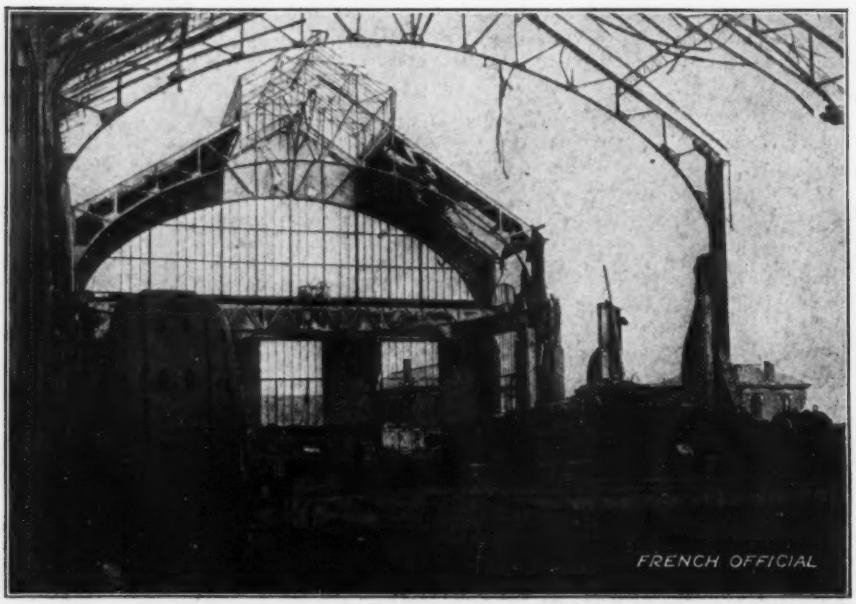
Against the eventual indemnities that will be paid, many partially destroyed buildings were repaired and put,



ONE OF MANY SUGAR FACTORIES LEFT IN RUINS BY THE GERMANS

more or less summarily, in a state of use. Almost all of these repairs were in agricultural districts, and the larger part of repairing was on buildings that would house the farm animals, crops, etc. Most of this repair work was wiped out by the German advance in the spring of 1918, but now that the Germans have retreated again and all this area is uncovered this same repair work is starting again.

In the Marne, the Meuse and the Meurthe-et-Moselle, where most of the destruction was caused in 1914, there has been some permanent reconstruction, particularly where the villages are over 30 kilometers from the front. Private contractors, working under the direction of local engineers of public works, have built a number of farm buildings in the region of Meaux and Chateau Thierry and summary repairs have been made to several towns and villages near the front. In 12 or 15 farming villages, south of Chalons-sur-Marne and around Vitry-le-François, the Government has organized coöperative societies for reconstruction. They have grouped almost all the property owners in the village in the society, and, by employing an architect and a contractor in common, they have not only been able to save a great deal of time, money and duplication in the rebuilding of their farm buildings, but they have been able to go to the Government and obtain the service of German prisoners and also to obtain special dispensation from the Army for procuring the necessary lumber, lime and cement, and transportation. In each case they have received the maximum advance on the eventual indemnity for their losses, which has allowed them to rebuild at once about one-quarter of the necessary buildings. In most cases they have started with the grange or grain barn. Over one hundred such have been permanently reconstructed in this region, costing, in all, $230,000.



ALL BUT THE HEAVIEST MACHINERY WAS REMOVED FROM THIS RUINED POWER PLANT IN NORTHERN FRANCE

The technical service of reconstruction has placed orders with private contractors throughout France for about 25,000 demountable wooden houses with two rooms and a shed in each case, costing $700 to $1000 each, and for 10,000 demountable wooden farm buildings, to cost $150 to $800 each.

Between 3000 and 4000 of these had been set up in the Somme and the Aisne and the Oise before the German advance of this spring, all of which were lost. To date, there are between 1000 and 2000 of these demountable buildings either in the newly liberated regions or on their way there, the great difficulty being to secure transportation and the necessary labor for mounting them. Since the armistice, however, the labor problem is being solved rapidly. As to labor, on Aug. 10, 1918, General Pétain sent a general order to the commanders of all divisions, regiments or companies, that when they found themselves located for several days or more in a devastated town or village, they should apply immediately to the engineer in charge of reconstruction work, to see how the soldiers could help either in cleaning up the ruins or putting the roads or water-supply in usable condition, or in doing agricultural work. On Sept. 6, 1918, the Minister of Liberated Regions instructed the local engineers in charge and the mayors of the towns to prepare advance programs of the work that such troops might do, so that no time should be lost. To prepare for eventual full reconstruction, the technical service of reconstruction of the Government is organizing a bureau to purchase building material in advance. It is expected that a credit of $60,000,000 will now be voted to this bureau, $20,000,000 to be available to house and feed workmen in the devastated regions while they are starting reconstruction. Materials and housing will be allocated from the Government storage yards to coöperative groups of contractors according to priority rules.

On Dec. 13, 1918, there was created in the Ministry of War a special service for supplying and setting up temporary barracks wherever needed for workmen or refugees.

Government Supplying Furniture

In July, 1918, the Minister of Liberated Regions asked for bids from private manufacturers on 75,000 articles of furniture, including chairs, tables, cupboards and wardrobes. At the end of August, 1918, it asked for bids on a lot of standardized doors and windows that could be made up ahead, including 20,000 exterior doors, 42,000 interior doors, 37,000 windows and 25,000 shutters. Today it is rapidly increasing these orders, especially to the plants that until the signing of the armistice were manufacturing airplane parts.

With regard to the Furniture Indemnity Law about

to be voted, which provides for paying damages for furniture loss up to $2000, the decree was issued by the Minister of Liberated Regions on Nov. 2, 1918, which allows the individual who has suffered loss of furniture to go out and buy his own furniture with an advance which will be made to him by the state of a sum which must not exceed $200 for the head of the family, and $40 for each other member of the family. If the damaged person prefers, the state will provide him with the furniture out of the stock which it is accumulating.

Virtually all the furniture in the regions which have been overrun by the Germans has been taken back by them into Germany or destroyed. The same is true of utensils, tools, bedding, clothing, etc. In the rich regions of the North of France this furniture was particularly valuable.

Furthermore, the technical reconstruction service is making experiments with building materials that can be found on the spot in devastated regions, and which do not require transportation or special labor for their extraction and preparation, and it is erecting an experimental building in Paris to try out methods of construction, new materials, new types of plans, etc.

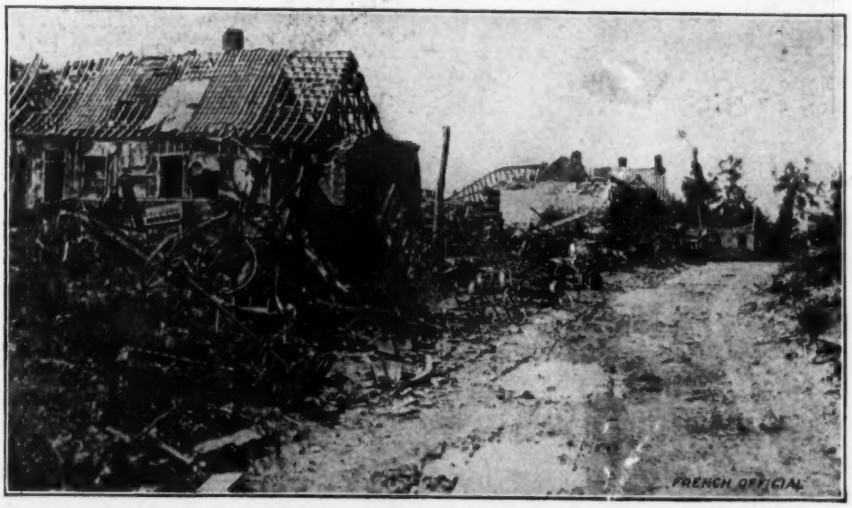
The service published on Oct. 22, 1916, a report showing the distribution of quarries and, in general, the places where the raw building material could be obtained in the individual departments. For example, good building stone can be found in almost all of the departments except the Nord and the Somme. Brick clay can be found in almost all the departments, especially in the North. The only difficulty would be getting the necessary coal for burning the brick. There is plenty of good building sand in all the departments. Cement can be produced in large quantities in the departments of the Pas-de-Calais, Marne, Meuse, and Meurthe-et-Moselle, provided the plants can have the necessary coal and labor. Most of the departments can furnish plenty of lime, which will probably play a much more important part in the reconstruction than it did in construction before the war. Tile can be produced in quantity, and in the Ardennes there used to be thousands of little shops that produced hardware. As for wood, all the departments can furnish some, but how much will be available will not be known for some time. Roofing slates can be produced in large quantities in the Ardennes and the Meurthe-et-Moselle, also in the Nord and the Pas-de-Calais. Glass comes from the North, from the Aisne and from Belgium. The chief things needed, however, to provide each of these materials, are the necessary tools and machinery for extracting and preparing them for general use, and the technical service of reconstruction is trying to accumulate stocks of such supplies in advance.

In the spring of 1917 a million acres of land were released, of which at least 500,000 were tillable. During 1917 the tractor service of the Department of Agriculture plowed 80,000 acres, the French Army plowed 12,000 acres and the British Army plowed about 50,000 acres. At that time the Government owned 800 tractors and had on order 1500 more. It is probable that it has today over 1500 tractors, of which half are available for the devastated regions.

During the last German retreat the wheat was cut on 130,000 acres of released land. In this work, 16,993 men were employed, mostly military; 3324 horses, 9895 scythes and sickles and 823 binders.

During the summer and autumn of 1917 the Office of Agricultural Reconstitution, through the special mission of the agricultural coöperative societies, founded 120 agricultural coöperative associations in as many villages in the Somme, Aisne and the Pas-de-Calais. These coöperatives include in some cases in their membership nearly all the farmers in the commune. Among them they had nearly 100,000 acres of land under cultivation, and had a total membership of nearly 8000. Virtually all of them were wiped out by the German advance in the spring of 1918. The mission is trying to reorganize them and to create other coöperatives to stock them with implements, machines and cattle, so that they can start operation as units on their return to their native villages. The $20,000,000 credit which was recently voted for encouraging agriculture is being used in part for the founding of these coöperatives.

The Office of Agricultural Reconstitution is in charge of the work. It did all that it could to prepare for plowing and planting a section of released land last autumn. It would like to allow many thousands of the land proprietors to return, with their families where necessary, and to provide them with German prisoners or soldiers to help them. But, most unfortunately, it was almost impossible to provide for the plowing and cultivation of this land, aside from the fact that labor is extremely difficult to get, as there were very few horses and oxen available. Some 12,000 horses were taken every month for the American or French Armies, and even where the horses are available they cost today about $1000.



WRECKED FARMING IMPLEMENTS LIE HEAPED ABOUT RUINED COTTAGES

But what is worse, if the horses and cattle had been taken into the devastated regions it would have been almost impossible to feed them, for the Army needed all the oats that could be brought into the regions. To replace the horses the Government ordered a large number of tractors and several types of agricultural machinery, but deliveries are slow and not adequate to the demands. The Government has contracted for $8,000,000 worth of agricultural implements, but so far very few of them have been delivered. The Government is making advances up to $160 per acre, to help put back under cultivation land overrun by the Germans.

The result is, that while France needs all the crops that can be raised on the liberated farms, it seems to be impossible to get the crops started and taken care of, until the military situation permits. The immediate need is for large quantities of agricultural machinery and implements, and especially for horses and oats.

WRECKED BUILDINGS AT COAL MINES

About Dec. 1, 15,000 horses were released by the Army for agricultural work in the devastated region.

To meet the enormous need for industrial materials, machinery and tools, after the war, the Office of Industrial Reconstitution has been organized and has been composed half of officials and half of manufacturers. It has a credit of $50,000,000 to arrange for buying up raw materials, machinery, tools, etc., and it arranges for ceding them to the injured manufacturers. It is not equipped to buy and sell on a large scale itself, but has entrusted its credit to a private body organized for this purpose. This organization, formed in the first year of the war, is called *L'Association Centrale pour la Réprise de l'Activité Industrielle dans les Régions Envahies.* It is composed of most of the industrial people in the invaded departments. Its object is to employ every useful means for restoring the machinery and stocks destroyed. However, according to French law, the group cannot trade. It can only be a consulting and plan-forming body, therefore it created the *Comptoir Centrale d'Achats Industriels pour les Régions Envahies.*

The latter has a capital of $200,000. It has a council which controls all buying and selling and which authorizes the projects of each of the subcommittees for each kind of industry to buy and sell. Each project must also be approved by the Office of Reconstitution, which allocates the necessary funds from its credit. The *comptoir* can buy directly for a private owner, or it can constitute general stocks for later use. The recipient can pay for tools or machinery in cash, or he can have the total deducted from his eventual state indemnity. Cash is not given to the manufacturer. This is to save his money by wholesale quantity buying and to prevent the unfortunate effect on the market of a number of little buyers competing against one another.

At present these services have effected purchases to the amount of about $12,000,000 and prepared orders for machinery, tools, and raw materials for more than $40,000,000. These orders are especially assigned to the reconstitution of coal mines, of central electric power plants and of their distribution works, of general tools, etc. Other orders, to a total amount of $30,000,000, are now being prepared for textile industries, breweries, sugar mills, oil and grease plants. Supplementary credit on new orders is expected in a short while. The *comptoir* can, by its constitution, make no profits; merely its running expenses and 5% on its actually paid-in private capital.

Latterly, the association has been agitating for the organization of coöperative societies among manufacturers of the same kind of material. One such has already been formed among the steel manufacturers. As they cannot all be reëstablished at once, the first one or more to start operate against capital or advanced indemnity credit, furnished pro rata by all, and the profits are divided pro rata. Aside from allowing all to get some start almost immediately, it means a considerable saving to all by permitting extensive standardization of building plant, machinery, tools and stocks. The association is also keeping track of skilled labor in the respective industries, so as to have it ready when the plants are available.

The leading societies of architects in France have been working since the beginning of the war to make plans for reconstruction. They have a great deal to do with the recent organization in the French Government for handling the work in the invaded departments. They are now organizing coöperative societies among themselves for reconstruction. They have organized an exhibition of cheap housing, which took place in the garden of the Tuileries in the summer of 1916. In the autumn of 1917, together with the Ministry of Fine Arts, they organized a competition among architects, engineers, sanitarians and agricultural experts throughout France, for the production of better types of farm houses and town buildings of various sorts, with due reference to the regional architecture and customs.

The contractors of France, through their large associations, have worked with the Government in the creation of its present policy, and many smaller groups have been formed to prepare for reconstruction. The national associations have just formed a group of coöperative societies for handling reconstruction. The initial buying of materials and caring for labor will be aided by the Government.

The agricultural societies have also taken an active part in preparing for the reëstablishment of agriculture, and meanwhile they have been a great help in bringing immediate relief to the returning refugee farmers.

The sanitarian and public health groups have also taken an active part in preparing for the industrial reconstitution of the invaded departments, and in particular the new society called the *Association Nationale pour l'Expansion Économique* has made full studies of the industrial, commercial and agricultural needs, and has made extensive preparations for after the war.

From the standpoint of town planning, the society created since the war called *La Renaissance des Citiés* has already made full studies for the improvement of the plans of Arras, Albert and other towns. It is now collaborating with the mayor and the council of Chauny to hold a big competition for plans for the improvement of the layout of the town.

From the legal side, *La Fédération Nationale des Associations Départmentales des Ministrés*, the judicial committee of *La Renaissance des Citiés*, the judicial committee of the *Union Centrale des Comités des Réfugies and the Comité d'Action pour la Reparation Integrale des Dommages de Guerre* have all made extensive studies of laws affecting refugees, war indemnities, redistribution of farm land, sanitation, etc. They are all having a strong influence on the legislation now before the French Parliament.

Reconstitution Work Done by Private Groups

A great many societies and individuals have been doing important relief work in the invaded departments. Their work is now coördinated in a special bureau of the Ministry of the Liberated Regions. They have been giving or selling clothing, furniture, cooking utensils, farming implements, seeds, fertilizers, farm animals, bedding and food to the returning refugees. The American Red Cross has had a delegate in each of the invaded departments, with several assistants in each department. They worked directly with the French authorities, and have distributed large amounts of urgency supplies in these regions.

The Anglo-American Friends' Mission has been working in the devastated regions ever since the beginning of the war. Its first work was in the Meuse and the Marne in the district between Vitry-le-François and Bar-le-Duc. In the spring and summer of 1917 they did splendid work in the Aisne and the Somme. They have several workers, men and women, in the field distributing relief of all kinds. Now they are planning a big reconstruction effort southwest of Verdun.

The Smith College Unit did similar relief work in about 25 communes around Grécourt in the Somme, until driven out last spring. Some 30 or 40 other French, British or American groups have been doing general or local relief work in the devastated regions. The Minister of Liberated Regions is now distributing among these and other groups the relief work to be done soon.

As regards repair work, the American Red Cross during 1917 repaired with its own labor about 75 buildings in five villages in the Somme, northeast of Nesle and northwest of Ham, and south of Péronne. The Anglo-American Friends mounted 51 demountable barracks in six villages near Ham and at Gruny, near Roye, in the Somme and repaired about 30 or 40 buildings in the Marne and the Meuse; during the first three years of the war they repaired several hundred buildings, especially in the towns of Sernaize, Pagny, Heiltz-le-Maurupt. They are now back at work in the Aisne and the Meuse.

The Californian Mission of Mrs. Crocker and Miss Daisy Polk adopted the village of Vitrimont in the Meurthe-et-Moselle and have repaired almost all of the 50 properties in the town. Various French cities and towns have adopted destroyed towns and villages. For example, St. Mihiel has recently been adopted by Nantes, Lyons has adopted St. Quentin and other towns in the devastated regions, and there are many other more or less official cases of such adoption.

The Reconstitution Research service of the American Red Cross has been working directly with the French Government and with most of the leading French associations and societies, to help them to establish a program of after-war reconstitution work, especially to aid the small farmer and workingman. The policy has been to bring together the leading French specialists and authorities to consider the problems of common interest with regard to after-war reëstablishment, and to secure an agreement on standards of practical improvements to be adopted in the planning, construction, furnishing and equipping of houses, farms and town buildings, with a special view to sanitation, economy and operation. The intent is, that once these standards are determined they shall be given general publicity among the returning refugees, with a view to getting them adopted in the reconstruction of the buildings and the reëstablishment of the livelihood of the people. A number of tracts have been published and a number of typical improved plans, with specifications and data, have been prepared. An extensive library and documentation on all phases of reconstruction have been collected, and the most useful material has been briefed. Everything is ready to start a big campaign of propaganda, with special emphasis on improving sanitation and hygiene.

Control of Main Routes by State Commissions

That the control of a state-wide system of roads should be vested in the State Highway Commission is the opinion expressed in the latest annual report of the Alabama commission. The present law gives the initiative in all construction work to the counties, but the report states that while this generally works to the benefit of the county, it frequently is not to the best advantage of the state. A trunk-road system of about 3000 miles was designated by the last legislature, of which about 1500 miles are constructed and in good condition. However, many short gaps in important trunk lines occur at the borders of counties, as the county officials neglect these portions and will not apply for state or Federal aid for their improvement. It is held, therefore, that the State Highway Commission should have authority to improve these neglected sections, in order to make the trunk roads continuous as intended.

Pay and Position of Engineers in Railway Service

Comparison with Wages Paid to Solicitors, Machinists and Trainmen Shows Low Relative Compensation For Technical Men

By Charles Whiting Baker
Consulting Editor "Engineering News-Record"

AT THIS time, when public attention is concentrated as never before on the railway transportation lines of the country, it is surely opportune to call attention to the position which is held by professional engineers in the railway service. Rather let us say the *lack* of position; for the unfortunate fact is that the average engineer who works for a railway company receives lower pay than the mechanics working in the repair shops and very much lower pay than the employees in train service.

Many of the men engaged in railway engineering have spent four years or more in acquiring a technical education, have long experience in practical work, and are performing responsible tasks, where the application of their technical knowledge and ability has an important influence on the economical use of both material and labor; yet the average compensation of these engineers is about the same as that of the hostler who cleans a locomotive in the roundhouse, or of the man who handles trunks in the baggage car. As for the aristocrat of the railway service—the man who handles the throttle of a passenger locomotive and whose right to the title "engineer" has often been protested by the men who hold engineering to be a profession—he draws monthly from the pay car nearly twice as much money as the average assistant engineer or draftsman receives.

The inadequate compensation of railway professional engineers is not merely a flagrant injustice to men who give to the railway service the results of long years of technical study and experience; it is the most wasteful sort of economy thus to misuse the men whose ability the railways greatly need in order to solve the difficult problem of increasing the economy and efficiency of railway operation.

Inadequate Compensation of Long Standing

The inadequate compensation and lack of position of engineers in the railway service is a matter of long standing. It has come to the fore recently, since Government control of railways was established, because the organization of the Railroad Wage Commission by the Director General gave opportunity for the engineering employees to present their pleas for higher pay.

Furthermore, the engineer, like every other man, has had to face a rapidly mounting increase in the cost of living for himself and his family during the four years of the war. While his salary was meager enough for his living expenses in 1914, he received practically no increase of any consequence since then until the general advance in all railway wages was put into effect by the Railroad Administration last year.

It has long been known in a general way that railway engineering service was inadequately paid. The professors in leading engineering schools, in advising their young graduates where to look for positions, have in many cases warned them of the small pay and slow promotion which they could expect in the railway service. There are probably few, however, in the profession—outside of those directly in railway service—who realize what the engineer who works for a railway company has had to contend with.

It seems worth while, therefore, to present in considerable detail the facts and figures as to the pay of railway engineers, compared with that of other classes of employees. These have been obtained from the official statistical reports of the Interstate Commerce Commission and the report of the Railroad Wage Commission, supplemented by the recent official orders increasing wage rates. The last published statistical report of the Interstate Commerce Commission was for the year which ended June 30, 1916. The report of the Railway Wage Commission continues the figures down to 1917.

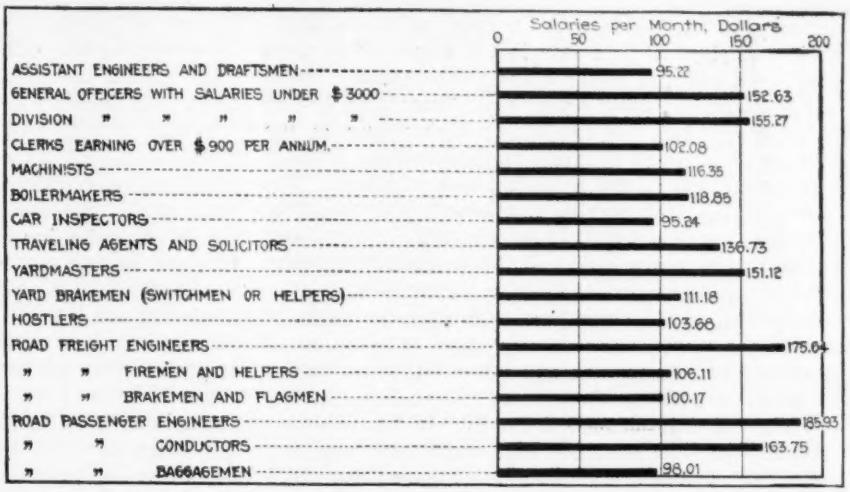
Salaries of Railway Officers

The Interstate Commerce Commission classes all those engaged in railway engineering service under the title "Assistant Engineers and Draftsmen," with the exception of engineers who hold such positions of authority that they are included under the heading of "general" or "division" officers.

Of course, a considerable number of the engineers engaged in railway work are classed as "officers," and it may be well just here, therefore, to drive a nail into the current fallacy that the average railway officer is in receipt of a princely income. The fact is, that while a very few of the highest railway officers, such as the president and the vice-presidents on a large system, receive liberal salaries (especially when they are in close relation with the financial interests which control the company) the rank and file of the officers on whom the responsibility for operation chiefly falls receive salaries which are on the average much below those paid by manufacturing or commercial bodies for the assumption of similar heavy responsibilities.

The Interstate Commerce Commission's figures for the year which ended June 30, 1916, make the following showing for the officers of Class I companies (those having gross earnings exceeding $1,000,000 per annum): The total number of general officers drawing salaries above $3000 per annum was 3958, an average of two per 100 miles of line. The average daily pay of these general officers was $20.75. Their total salaries amounted to only $26,217,000, which was less than 2% of the total payroll of these railway companies. Of the general officers with salaries under $3000 per annum, the total number was 3312. Their average salary was $5.60 per day. Of the division officers there were 1098 who drew salaries above $3000 per annum, and 8878 whose salaries were less than that amount. The average daily pay of these higher division officials was $7.10 and of the lowest paid men $5.01.

When it is borne in mind that these figures include the officials of all departments of the railway service it will be obvious that the engineers constitute no very large percentage of the number. These figures make it evident also that the men who are holding these official positions are not in receipt of what can be called high salaries. If the salaries of the few very highly paid officials, such as the president, had been deducted from the above figures before the averages were made up, it would be even more obvious that the rank and file of the railway officers were receiving nothing extravagant in the way of salaries in 1915. The figures presented in the table which accompanies this article show that, like many other salaried men, they have had to face the rapidly mounting cost of living during the war with practically stationary incomes.



COMPARISON OF SALARIES PAID TO RAILWAY PROFESSIONAL ENGINEERS AND OTHERS

Assistant Engineers and Draftsmen

Let us turn now to the rank and file of engineers in railway service who are not listed as officers. They are all grouped together, whether employed in the chief engineer's department, the motive-power department, or in any other branch of railway work, as "assistant engineers and draftsmen." There were 8879 such men employed by Class I railway companies in 1916, *and their average monthly pay was $93.76.* The Interstate Commerce Commission figures state the average compensation per day of these men as $3.45.

It has been said that the best way for a man to cultivate optimism is to regard the lot of someone who is worse off than he is. It is well to set down, therefore, for the benefit of assistant engineers who are lucky enough to have jobs with the Class I railway companies, that their fellow members of the profession who had jobs with the Class II railway companies (those having earnings between $100,000 and $1,000,000 per annum) made average daily earnings in 1916 of only $2.88.

The draftsmen and assistant engineers who worked for the little branch railways, included in Class III (earning less than $100,000 per annum) earned on the average $2.817 per day. No doubt the seven-tenths of a cent looked good to these men. Fortunately for the profession, these Class III railway companies get along with only 41 assistant engineers and draftsmen, though their total extent is 8762 miles. It is evident, therefore, that the financial slough in which these small branch railway companies, almost without exception, wallow is not due to extravagance in payment for engineering service!

Turning back to the assistant engineers and draftsmen working for the Class I railway companies, it is worth noting that their pay varies considerably in different parts of the country. Those working in the Eastern district, which includes the principal trunk lines, were paid in 1916 an average of $3.58 per day. Engineers in the South have to get along with $3.38, and on the railways west of Chicago the compensation is $3.33 per day.

Now let us see how the pay of these assistant engineers and draftsmen in railway service compares with the pay received by other classes of railway employees. In the accompanying table a comparison is made for certain selected classes of employees, including a number of those which have earnings approximating or exceeding those of the engineers. The first two columns of this table give the total number of employees in each class in 1916 and the total wages paid to them as given in the statistical report of the Interstate Commerce Commission for that year. The next three columns, showing the average monthly earnings in 1915, 1916 and 1917, are taken directly from the report of the Railroad Wage Commission to the Director General of Railroads. The last column contains figures computed from the general order increasing wages issued by the Director General last May, modified by various supplementary orders, under which railway employees of all classes have received in 1918, it is stated, $636,000,000 more than they did in the year previous.

Only an Approximation Possible

It should be said for this last column that it is necessarily only an approximation. The allowances for overtime, minimum wage rate, etc., for the mechanics working on the hourly basis and for the train employees paid on the mileage basis make an accurate statement of actual average yearly earnings impossible until the statistics of the Interstate Commerce Commission for 1918 are finally made up. The figures in this last column are accurate enough, however, to give a fair idea of where the professional engineer finds himself at the present day in comparison with the mechanics in the shops, the employees in the train service, and other railway men.

There is no intention here to discuss at length the increases which have been made in railway wages, or to criticize the action of the Federal railway managers. They had to cope with conditions which compelled large

increases to the mechanics in the shops and to the train-service employees. The men in the repair shops were absolutely essential to the railway organization under the conditions existing a year ago. Something had to be done to offset the temptingly high wages in the munition plants and to recognize the situation of these men on account of the mounting cost of living. The rights of the train-service employees under the Congressional enactment of 1916 establishing the eight-hour day had to be recognized; and the Brotherhood officers were not negligent in insisting on these rights.

It is well to set down here just what the basis of pay is, for these classes of employees. The wages of machinists, boiler makers and other skilled mechanics employed in railway shops were raised last year by "Supplement 4 to General Order 27," in the following manner: A basic minimum rate of 55c. per hour was established, and to this rate and any higher rates which were in effect Jan. 1, 1918, there was added 13c. per hour, making the minimum base rate 68c. per hour. For any work in excess of eight hours, time and a half is allowed. At this rate, with no overtime earnings, a machinist would receive $5.44 per day or $141.44 per month of 26 days.

Most of the employees in railway train service are paid on a mileage basis, and an elaborate table was published in General Order 27 showing the amount of increase in proportion to past wages for each class of train-service employees. It is impossible to apply these increases to the past average earnings of men in train service, shown in the table herewith, so as to determine just what average pay these men are now drawing.

It has been assumed, therefore, that the general percentage of increases in mileage rates which was established by Order 27 will represent a fair average for all classes of train-service employees. These percentages of increase were as follows:

	Per cent
Road freight engineers	15½
Road freight firemen and helpers	34½
Road freight brakemen	39½
Road passengers engineers	11½
Road conductors	15½
Road baggagemen	38½

These figures, however, obviously do not tell all the story, for under the Adamson law as enacted in September, 1916, all the train-service employees now receive time and a half for all work over eight hours.

How much the eight-hour day is increasing the average earnings of railway employees in addition to the increases in wage rates established by the Railroad Administration will not be known until the Interstate Commerce statistics are available, nearly two years hence.

Those who know what is going on in the railway service, however, believe that a very considerable amount of railway revenue is now being paid out for overtime which is only made necessary by the employees themselves. In fact the time-and-a-half pay for overtime establishes a premium on petty graft in the railway service—petty, that is, as far as the individual is concerned, but anything but petty in its effect on railway revenues.

It need not be assumed that the train-service employees are satisfied with the increases which they received last year. Late reports from Washington state that they are seeking additional increases from the Railway Wage Board which will raise their total pay by something like $100,000,000 per annum, and a possible further increase in freight rates is said to be under consideration to meet this new demand.

It may be said that all this is not pertinent to the question here discussed as to whether the professional engineers in railway service are adequately paid for their work. But the standing excuse for the meager pay to engineers has long been that the railways were too poor to pay any more. It is therefore, pertinent to show that if the railways can let their revenues be dissipated for over-time pay for work that could often be obviated they can surely afford to pay a living salary to their professional engineers.

Let it be here set down also that the professional engineer in many cases gets neither time-and-a-half nor any extra pay whatever when he works overtime, as he is often obliged to do. In the days when railway surveys were a big factor in American engineering work, the engineer was accustomed to work from daylight to dark in the field, and to amuse himself in the evenings by writing up notebooks, drawing maps and in similar pleasant recreation. Somewhat of that tradition still survives among railway engineers. They are supposed to be on the job whenever the exigencies of the service demand, all at so much per, and their esprit de corps dignity would suffer, it is assumed, by the payment of extra compensation for over-time work!*

In the orders which have been issued granting increases of pay to various classes of railway employees the engineer *has never attained the dignity of a separate classification.* According to our information, all the men in railway service classed as "assistant engineers and draftsmen" by the Interstate Commerce Commission are included under "Supplement 7 to General Order 27." We quote as follows from this order: "For all employees who devote a majority of their time to clerical work of any description, including train announcers, gatemen, checkers, baggage and parcel-room employees, train and engine callers, and the operators of all office or station equipment devices, establish a basic minimum rate of $62.50 per month. To this basic minimum rate and all rates above, in effect Jan. 1, 1918, add $25 per month."

Thus, the professional engineer with technical education and experience finds himself classed with clerks, train announcers and the men who check baggage, as far as pay is concerned, and, it is a fair corollary, as far as position also is concerned!

What does all this mean to the professional engineers who are striving to do their work under such conditions? It means that for the past four years they have had to support themselves and their families on an average salary smaller than the wages of a chauffeur; that they have had to do this while year by year the cost of food and clothing and other necessaries of life

*Recent orders of the Federal Railway Administration have made some allowance for overtime work by engineers. For example, in a certain railroad office in New York City the assistant engineers and draftsmen have the same hours as most office workers there, from 9 a.m. to 5 p.m. with an hour for luncheon. This is a 7-hour day. If the work demands an extra hour time, no extra pay is given for it. For the 9th and 10th hour extra pay at single time rates is given and after ten hours, time and a half. Where work is required on Sundays or holidays, extra pay is given at the rate of single time for 8 hours and after that the same as above. This is much more favorable treatment as respects extra pay for overtime work than has before been granted to engineers.

has gone on mounting. When an increase was finally granted this year it averaged only 27%, while the cost of the necessaries of life, according to the statistics of the Railway Wage Commission itself, has increased over 40% and general experience places the increase in the cost of living during the past five years at fully 70 to 100 per cent.

To expect a man to do good work under such conditions is to expect the impossible. The inevitable result is to tend to drive engineers out of the railway service into some other occupation where they can earn a decent living for themselves and their families.

Let us not comfort ourselves with the idea, either, that some of the engineers in railway service who hold responsible positions are earning salaries considerably larger than the averages here shown. We cannot get away from the fact that if a considerable number of railway engineers are drawing better salaries than are indicated by the figures above, then another lot of poor fellows are getting even less than the starvation pay which the above averages represent.

This situation above set forth, however, is of much more serious import to the public than are the hardships suffered by the ten thousand or so engineers and draftsmen in railway service. *The railway business is today suffering from its failure to give the engineer proper position and responsibility and compensation.* These engineers are using their brains, not their muscles, in the railway service. Upon their ability and initiative depend to a very large extent *the economy and efficiency with which the materials and the labor which the railway company buys will be utilized.*

As one studies the accompanying table of wage rates and the diagram, one must seriously ask the question: Where is the incentive for the railway engineer to use his best efforts to save money for the company? Does anyone thank him if he exerts himself to find a way to save material here, or to dispense with an extra man there? Director General McAdoo has called public attention to the serious breakdown of morale in the railway service. How could anything else be expected? Engineers are supposed to be in a position of authority over construction and other work. Their authority and their ability to look after the railway company's interests are neutralized by inadequate pay and position.

Contractors' employees doing work under direction of railway engineers are in many cases earning twice as much as the engineer who gives them orders. A recent letter describes the experience of an engineer of long experience in charge of construction work who had occasion to give an order to the brakeman of a train. The answer was prompt, "Who the hell are you to tell me what to do? My pay check is bigger than yours!"

How long would discipline and efficiency last in an army if the captains and colonels were paid less than the noncommissioned officers?

It is pretty well known in railway circles that the reason for the enormous increase in railway operating expenses is not merely the increase in the rate of wages but the falling off in the efficiency and industry of the employees. How is this to be remedied if the men who should be in authority are so treated as to destroy their initiative and their interest in their work?

AVERAGE MONTHLY EARNINGS OF CERTAIN CLASSES OF RAILWAY OFFICERS AND EMPLOYEES OF CLASS I RAILWAY COMPANIES (THOSE HAVING GROSS EARNINGS IN EXCESS OF $1,000,000 PER ANNUM) FOR SUCCESSIVE YEARS

Occupation	Total No. Employed in 1916	Total Wages in 1916	Average Monthly Earnings for the Year Ending June 30, 1915	Dec. 31, 1916	Dec. 31, 1917	Dec. 31, 1918
Assistant engineers and draftsmen	8,879	$9,925,050	$93.42	$93.76	$95.22	$120.22
General officers with salaries below $3000	3,312	5,909,462	151.88	151.91	152.63	175.95
Division officers with salaries below $3000	8,878	15,228,380	147.62	147.64	155.27	172.55
Clerks earning $900 and upward	61,667	70,788,932	94.05	99.16	102.08	127.08
Machinists	36,502	40,837,054	85.87	100.42	116.35	See note
Boilermakers	11,944	13,772,489	89.88	102.46	118.85	See note
Car inspectors	17,904	16,281,753	73.48	81.11	95.24	See note
Traveling agents and solicitors	5,925	8,858,663	123.83	130.54	136.73	158.10
Yardmasters	3,415	5,463,154	131.09	135.35	151.12	162.35
Yard brakemen (switchmen or helpers)	37,476	44,370,600	91.93	99.81	111.18	See note
Hostlers	7,031	7,229,807	80.95	87.93	103.68	See note
Road freight engineers	29,645	55,030,111	152.75	154.32	175.64	178.24*
Road freight firemen and helpers	31,499	55,511,425	94.10	93.82	106.11	125.72*
Road freight brakemen and flagmen	60,019	62,636,087	85.83	87.70	100.17	110.78*
Road freight passenger engineers	13,318	28,014,930	178.46	177.04	185.93	196.51*
Road passenger conductors	10,676	19,682,805	153.57	156.41	163.75	175.60*
Road passenger baggagemen	5,617	6,005,841	87.03	91.49	98.01	126.35*

NOTE—The establishment of minimum rates of wages with the eight-hour day and time and a half for overtime makes it impossible to state present average pay of employees paid by the hour. The increase, however, is undoubtedly much larger proportionally than the increase received by the engineers.

* Most of these men in train service are paid on a mileage basis and with the eight-hour day in force probably receive on the average considerably higher rates than those here given.

In this connection let emphasis be given to Director General McAdoo's recent declaration that "upon the efficiency of the country's transportation system the future prospect of the nation largely depends." Where is one to look in the railway service for the men of technical education and experience who have made a thorough study of the larger problems of transportation economies such as will fit them for leadership as railway officers? Where save in the ranks of engineers?

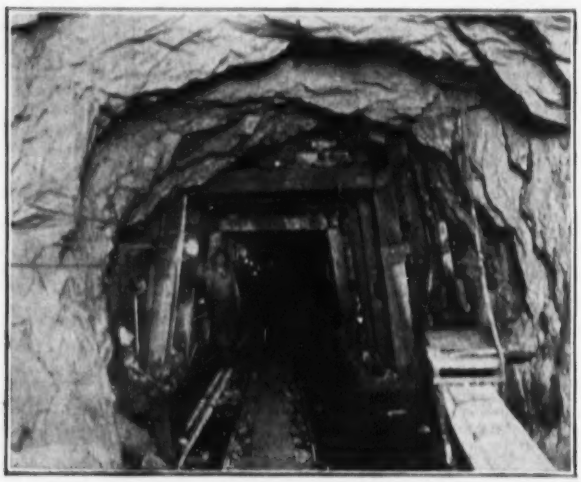
It is of the greatest importance to the country's welfare that young men of character and ability should be attracted to the railway service, and that their treatment and opportunities there should be such as to retain them. Obviously, the very reverse of such conditions exist today. The showing of the accompanying table and diagram will of itself be sufficient to make the bright young graduate engineer hunt anywhere else than in the railway service for a position.

What can the engineering profession do to remedy the conditions here depicted? The Engineering Council has appealed to the Board on Railroad Wages and Working Conditions, and is continuing its efforts; but the fact that the council is at work should stimulate rather than retard action by individual engineers and by organizations. Protests to that board (whose offices are at 1300 Pennsylvania Ave., Washington, D. C.) should emphasize not merely the inadequate pay of the professional engineers in railway service, but the unwisdom of classing them with clerks and low-grade workmen, when their authority and initiative are so important to the railway service.

The engineer is not asking better pay and position merely because he earns it and deserves it, as he undoubtedly does. It is because of the service that engineers can render in increasing economy and efficiency in railway operations that the value of that service should be adequately recognized.

Fluming a Stream to Unwater a Tunnel

WHEN the South Fork heading of the 18-mile tunnel on the Hetch Hetchy aqueduct had advanced about 300 ft., a heavy flow of water filled the 11-ft. width of the tunnel to a depth of about 4 ft. An examination showed that this water came entirely from the adjacent stream bed, through a geological fault line. Along this fault the rock had separated



FLUMING A STREAM STOPPED THE TUNNEL LEAK

about 6 ft., the fissure being filled with decomposed rock and gravel. The fault extends to the surface of the ground above and can be easily traced on both sides of the cañon.

Soon after the heading struck the fault the stream flow decreased by about as much as the flow in the tunnel, and plans were immediately made for diverting the stream into a flume above the fault line. The fall of the stream was such that 30 ft. of flume sufficed to bypass the water around the fault line. In the meantime timbers had been floated into the tunnel and work was continued; first the loose section, about 30 ft. long, where the tunnel crossed the fault line, was shored up.

After the stream was turned into the diversion flume, the flow in the tunnel decreased to an amount that could be conveniently handled by a 16-in. pipe. Some of this water is considered to be drainage from the fissure, and the remainder is ascribed to underflow beneath the stream bed. Beyond the fault line no water whatever was encountered. The heading was in about 700 ft. when visited by a representative of this journal in August. This work is being carried out by the City of San Francisco under the direction of M. M. O'Shaughnessy, city engineer.

Chlorination Interruptions Costly

Failure to operate water-supply chlorination plants continuously and effectively in several municipalities in New York has resulted disastrously for the inhabitants. Serious outbreaks of typhoid have been experienced, and, in one instance, the State Department of Health reports, 100 cases occurred in a town of 10,000 population three weeks (the usual incubation period) after the sterilization apparatus, through neglect, had failed to operate for five days.

Tests Show Value of Fine Grinding of Portland Cement

FINE-GROUND cement, specified to pass 90% through a 200-mesh sieve, is being used in the Government concrete ships. The tests on which this use was based are reported as follows in the annual report of the Bureau of Standards for the fiscal year which ended June 30, 1918:

"The series of tests, started in 1916, to determine the effect of increased fineness on the cementing value of cement in mortar and concrete has been continued. The two-year results show the same marked decrease in strength with the finer ground cements as did the tests of the previous year.

"With knowledge of the general results of this investigation the Emergency Fleet Corporation requested further comparative tests on various cements produced in the Southern districts, both as normally ground and as reground to a fineness of 90% passing the 200-mesh sieve. These cements were tested in 1:1:2, 1:1½:3, and 1:2:4 concretes and in 1:2 mortar. In practically all cases the increase in compressive strength obtained with the finer cements was from 50 to 100 lb. per square inch for each per cent. increase in fineness. From all the data obtained in this investigation the order of increase in strength which may be expected from finer grinding by ordinary methods is now fairly well established, and the question of requiring higher fineness in the standard specification for portland cement is a purely economic one. There remains, however, the highly interesting and almost wholly unattacked problem of producing cements of much higher fineness than is possible by ordinary methods of grinding. It may confidently be expected that if practical methods can be found of reducing cement clinker to a very fine state of subdivision, a decided improvement in quality will result. To determine what degree of improvement may be obtained is properly the next step in this investigation.

"The importance of further progress along these lines is commensurate with the difficulties to be overcome in developing new methods of grinding, and concentrated effort will be required to deal with the new problem effectively. Fortunately, some progress was made before the war by the development of an air separator and an air analyzer for the production and mechanical analysis of very fine cements."

Bonus Payments Speed Up Shaft Sinking

Well-organized shifts and bonus payments were largely responsible for the unusual speed of nearly 200 ft. a month for five months in sinking a 11 x 21-ft. rock shaft for the Seneca Mining Co., at Mohawk, Mich. A flat rate per day was paid up to the first 100 ft. per month; 2c. per foot per day bonus was paid for all over 100 ft. up to 150 ft.; 3c. per foot per day for all over 150 up to 200 ft. and 4c. per foot per day for all over 200 ft. per month. A total of 994 ft. of shaft was sunk in 129 working days in five months from May to September, or an average of 7.7 ft. per day. The highest monthly rate was 208 ft. in 27 days in May, and the lowest was 184 ft. in 24 days in September.

Experimental Data on Wood-Blocks—Use of Zinc-Treated Ties

Extracts from two of the papers presented at the fifteenth annual meeting of the American Wood Preservers' Association at St. Louis, Jan. 28-29, giving (1) the results of investigations on experimental wood-block pavement in Minneapolis, and (2) the influence of rainfall upon the durability of zinc-treated cross-ties.—EDITOR.

Progress Reported on Wood-Block Experiments in Minneapolis

BY C. H. TEESDALE AND J. D. MACLEAN
Engineers in Forest Products, Forest Products Laboratory, Madison, Wis.

THE object of this report is to discuss the results of investigations made on an experimental wood-block pavement, after 12 years' service under heavy traffic conditions. This pavement was laid in coöperation with the City of Minneapolis for the purpose of studying the relative merits of various species of wood for paving material, and to investigate the influence of the following variables: (a) Heartwood and sapwood; (b) length of blocks, and (c) angle of courses.

Seven species of wood were employed: Tamarack, Norway pine, long-leaf pine, white birch, douglas fir, Western larch, and hemlock. On account of the wide use of long-leaf pine as a paving material, this species was used in the test to provide a basis of comparison for the other woods. A detailed discussion of the material used, the method of treating the blocks, and the construction of the pavement, is given in Forest Service Circulars 141 and 194, the latter issued Jan. 16, 1918.

One of the difficulties encountered in an experiment of this nature is in the selection of a method for judging the conditions from year to year. In order to determine a basis of comparison, the following method was adopted: (1) Measurement of the blocks to determine the average wear; (2) estimation of the total number of square feet in a section below the general level of the street; (3) estimation of the total number of square feet ½ in. or more below the general level of the pavement.

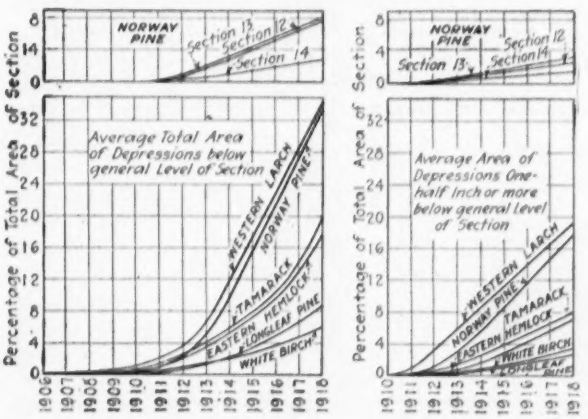
The wear of the various species was measured on a block removed from each section from a position about midway between the curb and the center of the street. It was selected from a portion of the pavement where the surface was fairly uniform. Measurements to the nearest $\frac{1}{16}$ in. were made at a number of points, and the average depth was determined. The difference between this and the original depth of the blocks was taken as the average wear of the section.

How Estimates of Depression Were Made

Estimates of the total number of square feet of depression below the general level of the surface, and ½ in. or more below the general level, were made independently by each member of the inspection party. These estimates were averaged and recorded. The data were plotted for each of the inspections and curves drawn showing the average results, as indicated in the diagrams in the next column.

In the early part of the summer of 1911 the douglas fir blocks were in such bad condition that it was necessary to relay the two sections composed of this species. Deep depressions had developed, and some of the blocks were badly broken. The failure of this wood after five years' service was probably due to the poor quality of the original blocks. To test this species further a quantity of Grade A material was obtained. There was not a sufficient amount of this douglas fir to replace entirely the sections removed, so the remaining area was paved with the regular yellow-pine blocks supplied by the city.

A good comparison of the durability of douglas fir with respect to the other species cannot be made at present, as the relaid material has been in use only seven



CURVES SHOW RESULTS OF INSPECTION OF BLOCKS

years, while all the other species have been in use 12 years. However, at the inspections made in the past two years, a very rapid increase in area of local depressions was observed. While these depressions are not deep at present, the area affected is in marked contrast to the surface of the yellow-pine portion laid at the same time.

Blocks of douglas fir which were removed for inspection showed an average wear and brooming from $\frac{3}{16}$ to ½ in., as compared with $\frac{3}{16}$ to ¼ in. for the yellow pine placed at the same time.

It will be noted from an inspection of the curves that it is impossible to predict the deterioration of a particular species from conditions observed during seven or eight years' service. Practically all of the species showed very small areas of depression for the first five or six years. After this period, however, the depressions suddenly increased in area at a very rapid rate. Results of the more recent inspections seem to indicate that the increase in depressions will be much more rapid in the future, and will necessitate the early replacement of some species.

There is no question that specimens of long-leaf pine and white birch are in a much better condition than

most of the others. The depressions in the white birch are somewhat more numerous and deeper than those in the long-leaf pine, but these depressions are largely due to the crushing down of blocks which were partly decayed before they were treated. Depressions in the long-leaf pine seemed to be due in a large degree to decay in the sapwood of individual blocks. Poor penetration, on account of moisture in the wood at the time of treatment, probably accounts for most of the cases of decay found in the sapwood.

Apparently, the white birch and the long-leaf pine may be classified on the basis of this experiment as about equally durable for paving purposes. An objectionable feature of white birch seems to be the difficulty in selecting material free from decay. The Norway pine section has large areas of depression and a considerable number of deep pockets. The bad condition of this section, however, is not a good criterion of the wearing qualities of the species. This section is triangular in shape, and therefore has but a small area which is not subjected to continually severe traffic conditions.

The Eastern hemlock seems to be in slightly better condition than the tamarack. However, there is not a very pronounced difference in the condition of these two species. The Western larch sections are in very poor condition. Compared with the other species, this wood has the largest percentage of area affected by depressions.

Measurements of wear were taken on all of the species until 1915. At this time the depressions had reached a state where it was not practicable to select blocks representing average conditions. In subsequent inspections a general estimate of the relative wear has been made. Beginning with the species showing the least wear at the last inspection, the approximate average wear and brooming is as follows: White birch, $\frac{3}{16}$ to $\frac{1}{4}$ in.; long-leaf pine, $\frac{5}{16}$ to $\frac{7}{16}$ in.; Norway pine, $\frac{1}{2}$ to $\frac{9}{16}$ in.; tamarack, $\frac{7}{16}$ to $\frac{5}{8}$ in., Eastern hemlock and Western larch, $\frac{5}{8}$ to $\frac{3}{4}$ inch.

Most of the wear on long-leaf pine and white birch blocks seemed to have taken place during the first five or six years of service. This was probably due largely to brooming of the fibers. Some of the other species, in which the wear was most pronounced, showed a general increase in wear from year to year.

Summary

1. The order of efficiency of service is as follows: (a) Long-leaf pine; (b) white birch; (c) Eastern hemlock; (d) tamarack; (e) Norway pine; (f) Western larch.

2. Since the relaid douglas fir has only been in service seven years, a good comparison of this wood cannot be made with the woods which have been in use for 12 years. At present the depressions and wear of this species are from two to three times as much as that of the long-leaf pine portion laid at the same time.

3. For most of the species the depressions were very slight during the first four or five years' service. After this period the depressions increased at a very rapid rate.

4. Certain sections show wearing qualities of Norway pine which compare favorably with those of long-leaf pine and white birch. These sections probably give a better comparison of the durability of this species than does the section which is subjected to unusually severe traffic conditions on account of its shape and location.

5. The Western larch sections have the greatest percentage of area affected by depression. This is also one of the species which shows the heaviest wear.

6. The order of the species, beginning with that showing the least wear, is as follows: White birch, long-leaf pine, Norway pine, tamarack, Eastern hemlock, and Western larch.

7. The presence of sapwood did not seem to be an important factor affecting the durability of the pavement.

8. The various lengths of blocks employed had no apparent influence on the wearing qualities of the pavement.

9. Less joint wear was noted in sections laid at 45° and 67½° than in the section of blocks laid at an angle of 90° with the curb.

Rainfall Influence on Durability of Zinc-Treated Cross-Ties

By C. H. Teesdale and S. W. Allen

Engineer in Forest Products — Industrial Examiner in Forest Products
Forest Products Laboratory, Madison, Wis.

THE scarcity of creosote needed in timber treating for the past two years, due to the restrictions on imports and the increased use of coal tar for fuel by the steel industry, has directed attention to the possible wider use of other treating materials, especially for cross-ties. Among those under consideration zinc chloride has been most commonly used, and a large number of service records on zinc-treated cross-ties were available.

Accordingly, it was proposed to plot these records on a map of the United States to determine if possible the relation between the location of successful tests of zinc-treated ties for different periods of service, on the one hand, and lines of equal rainfall, on the other. By this means it was hoped to suggest a more or less definite area where zinc chloride could be used to the exclusion of creosote.

The *Proceedings* of the American Railway Engineering Association and of the American Wood Preservers' Association were consulted for data on service tests of zinc-treated ties, and where exact locations were not shown they were determined by consulting original records from various roads, on file at the Forest Products Laboratory. The location of lines of equal rainfall were taken from Bulletin Q of the Weather Bureau, United States Department of Agriculture.

Three outline maps of the United States were prepared, showing the geographical location of test tracks containing zinc-treated cross-ties which had been in service for eight years, for 10 years and for 12 years. Those tracks where 25% or less of all zinc-treated ties had been removed in this period, and those where 50 to 100% had been removed, were designated by different symbols.

Comparatively few records are available south and east of the 40-in. rainfall line, which extends roughly from Galveston, Tex., through St. Louis, Pittsburgh, Albany, N. Y., and on to northeastern Maine. On the

map showing eight years' service, however, the tracks with less than 25% renewals, or the "successful" tests, are numerous near this 40-in. rainfall line, while seven out of a total of 13 "failures" are south or east of this line. Four "successful" tests are also located south and east of the line.

The data as plotted on these maps, while rather meager, indicate in a general way that the arid Western states, and the Central, Atlantic Coast and New England states north of the 40-in. rainfall line form a definite area where cross-ties treated with straight zinc chloride may be expected to give from eight to ten years' service. It is felt that the line might well be extended in its central part to include all the area north and west of the Ohio River drainage area, but sufficient data are not available to support this opinion.

Construction Camp Community Association Like Commission Government

TAYLORSVILLE, the camp community created by the construction forces of the Taylorsville Dam of the Miami Conservancy District, near Dayton, Ohio, has adopted a self-government plan modeled on commission government. The plan was initiated Nov. 29, 1918, by the organization of the Taylorsville Community Association and the adoption of a constitution. Work started with 67 members, and on Jan. 1 community government was in full operation.

All employees in the dam construction and members of their families who are over 16 years of age are eligible as members of the community association. Election is by ballot. Members pay an entrance fee of 50c., and annual dues of $1. Officers of the association are five commissioners who are elected from members in good standing who have resided at least three months at the dam site. Commissioners serve six months. The one receiving the largest number of votes becomes chairman and designates the heads of four departments from the commissioners elected. Each works through committees appointed by the commission. The present incumbents are D. D. Rogers, chairman and commissioner of social service; E. P. Come, education; F. A. Meyer, community safety; B. H. Petty, community service, and Roy Hutzelman, unassigned.

At present 13 committees are organized and at work. These include committees on schools and library, entertainment, relief, religious activities, fire prevention, law and order, health and sanitation, transportation, and gardens. Day and night schools and a Sunday school are in full operation. There is a regular program of entertainment, comprising moving pictures, concerts, lectures and dances, also provision for regular union church services.

The association meets regularly once a month and the commission meets as often as there is business to transact. Similar associations are in process of creation at the other construction camps of the flood-protection works.

Of course, it must be understood by the reader that these associations do not supersede in any way the legally constituted authorities of the minor civil divisions of the State of Ohio.

Topographic Engineers Assist in Military Mapping

Special Work of United States Geological Survey Meets Needs of War Department—School Trains New Topographers Quickly

By R. B. Marshall

Major, Engineers, United States Reserve, Chief Geographer, United States Geological Survey

WHEN the call for mobilization came in the spring of 1917, there was a demand from the War Department for topographic maps of our borders and our coasts. No other scientific bureau of the Government was more ready to respond to the call than the United States Geological Survey. No other single large group

SURVEYING THE COOPER RIVER AT HIGH TIDE

of technical men in the country offered their services so early or in so large proportion to their numbers as the survey's topographic engineers.

In requesting that the Geological Survey divert its maximum activity toward topographic work, the War Department merely sought to utilize an organization already existing and fully equipped. To provide further support for this work continuously throughout the year, it allotted practically all its appropriations for topographic surveys, and Congress appropriated large additional sums for military mapping. In order that the department might exercise full authority over the plans for this work, Geological Survey men, as fast as commissioned in the Reserve Corps, have been detailed to report to the director of the survey "for duty in connection with military mapping now being done for the War Department." Thus the organization for topographic work is essentially military, the former chief topographer being now a major in charge of all Geological Survey topographic work under the War Department, and practically all his division-staff assistants and many of the topographic engineers are commissioned men.

When Villa raided Columbus, N. M., and Pershing struck off southward through Mexico, and when bandits ventured into the "big bend" country of southern Texas, there were no accurate maps of those areas for ref-

COUNTRY RECENTLY MAPPED ALONG THE RIO GRANDE RIVER

erence. Today such maps exist, and many more maps of areas along the border are ready and in the making. There was no delay when the need came for men both trained in topographic engineering, inured to the life of the desert, the swamp or the mountain fastness, and equipped to serve far from base, in country lacking in water and fuel.

It was only necessary to divert to new fields men who had had years of topographic experience in all sorts of country and climate. When, therefore, the request came overnight for such mapping, in two days parties fully organized were on their way to new stations on our coasts and borders. The areas mapped by these military surveys from Apr. 1, 1917, to Feb. 1, 1918, aggregate 23,552 square miles.

The organization and field methods of any one of these parties thus spread out along the Mexican border in several states are typical. The unit of survey is a 15-min. "quadrangle," an area measuring 15 min. in latitude and in longitude. An experienced Geological Survey topographic engineer is the party chief and is assisted by two or three associates; each of these men is individually responsible for the mapping of the portion of the quadrangle assigned to him. Scientific field assistants, recorders and rodmen complete the technical organization, and these are supplemented by the necessary teamsters, cooks and other helpers.

Transportation to and from the railroad base, perhaps 50 to 70 miles distant, is furnished by Army auto trucks and Army drivers. The men live in tents and travel to and from the day's work in the saddle, for roads are few and cross-country travel is customary. The motor trucks maintain the necessary subsistence and forage, but the camp must find such fuel as the country affords, or even pack water to a camp that is dry. This latter condition is frequently met, for the country is largely desert or "bad lands" and most of the streams are intermittent, such as are found where the annual rainfall rarely exceeds 10 in. Water is obtained from deep wells sunk at much expense by cattlemen, and also from surface "tanks" which impound the run-off resulting from torrential rains. As the work progresses camp is moved by the supply trucks.

In advance of the detailed topographic mapping smaller control parties carry triangulation and primary levels over the areas to be mapped, and the results of this control are computed for the immediate use of the main camps that are to follow. Mapping is done by the plane-table method, supplemented by the plane-table and stadia along the roads or trails and in the less exposed lowlands. The mapping also includes a complete classification of the land as to woodland, brush, water-supply and other features, so as to yield a complete inventory of the physical and economic aspects of these parts of our border. The topographic engineer is thus a pioneer also; those who follow him need not to ask or wonder what it is like "beyond," for his map will tell.

To prepare the field sheets for reproduction and immediate printing, a largely augmented force of draftsmen, of which women are forming an increasing number, has been organized at the Washington office. All field data are sent there as fast as they are completed. The resulting topographic maps are photolithographed in colors for the immediate use of the War Department. They are published on a scale of approximately 1 in to 1 mile, and with a contour interval of 10 to 50 ft., the interval employed depending on the surface relief.

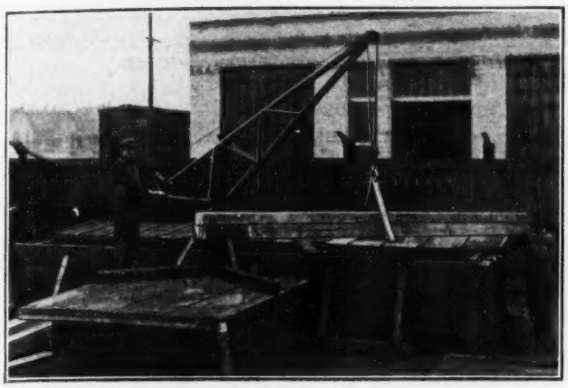
In order to maintain this force of engineers, to offset the detail of topographic officers to France on the one hand and the increasing war demands for topographic mapping at home on the other, some fifty officers, not heretofore connected with the Survey, were detailed to it from the Engineer Officers' Reserve Corps. A training school for topographers also was established. The officers detailed from the Reserve Corps were sent direct to the parties already in the field, for gradual training in the topographic work. The training school gave candidates about a month's actual field experience in a day "camp," established just outside of Washington, the men returning to the city each night as contact with office headquarters is thought to be essential to give the training its full value.

Permission having been obtained to appoint topographic field assistants without recourse to the Civil Service Commission, and without establishing a status in the classified service, about 100 such men were appointed. Most of them were obtained from the technical schools. After about a month's observation and training they were detailed to the field parties where they were most needed or where their special fitness indicated that they might be most useful. Most of these men were subject to the draft, and some were called. Others have had opportunity to enlist or to be inducted into engineering regiments where their training was needed, and they served largely as assistants to former Survey men who held engineer commissions.

Non-Pressure Treatment of Wood for Buildings

Applying Preservative at Site by Simple Processes Prevents Decay at Low Cost and Allows Use of Local Supplies

OPPORTUNITIES for extending the use of creosoted timber in the construction and repair of industrial buildings and structures, by wider use of the simpler and cheaper methods of treatment which give a sufficient degree of protection and which can be applied at the site without elaborate or expensive plant, are indicated in information compiled recently by Kurt C. Barth for the Barrett Co., Chicago. While it is admitted that the pressure or closed-tank process gives the most efficient results and the deepest penetration, its cost may be prohibitive when the amount of timber

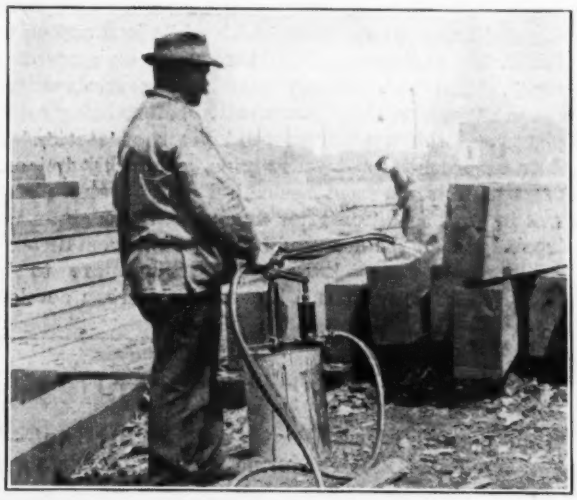


SMALL TANK AND HAND CRANE FOR TREATING TIMBER

treated is comparatively small, when heavy treatment is not essential, when the buildings must be of low cost, or where distance from a treating plant would involve high freight charges on the treated timber.

Non-pressure processes which can be employed at any point and are effective in retarding decay are shown to be applicable under the above conditions and to have been used with success on timber for mills, mines, industrial buildings, coal and gravel bins, dwellings and other structures. They are of two classes, the open-tank treatment and surface treatment. For the open-tank process the framed and bored timbers are immersed first in a bath of refined creosote oil having a temperature of 150° F. to 200° F., and are then transferred to another bath in which the oil is not over 100° F. The cooling effect, following the hot bath, results in a condensation of the heated air and moisture which assists the atmospheric pressure and capillary attraction in causing penetration of the oil.

The time is the same for each bath, and depends upon the kind of wood and the size of the piece. One hour per inch of maximum thickness is the average for close-grained woods, and 15 to 30 minutes per inch for species more susceptible to treatment. For large sticks, however, the one bath may serve both purposes, the timber being left immersed and the liquid allowed to cool after the required period for the hot treatment. For planks and small pieces the hot bath may be sufficient. Loblolly pine has absorbed 8 lb. of oil per cubic foot after one hour in the hot bath. Large yellow-pine sticks absorbed

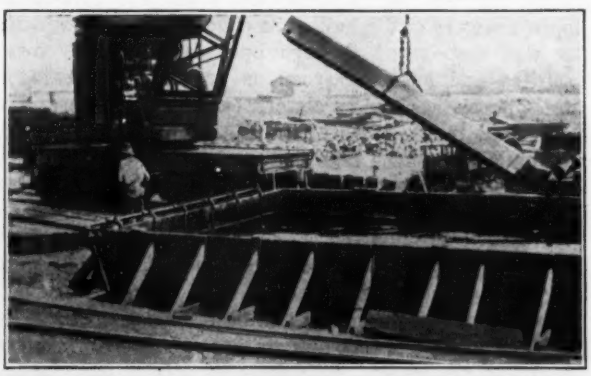


APPLYING PRESERVATIVE TO TIMBERS BY SPRAYING

10 lb. per cubic foot after being in hot oil for six hours and then left for 12 hours while the liquid was cooling.

Surface treatment with oil may be effected by means of a brush or mop, a spraying device, or by dipping, the last named being a modification of the open-tank process. Heated refined oil is used in all cases. Two coats are required for brush application, while spraying with one coat is said to give better results besides requiring less time, material and labor. All framing and boring must be done before treatment, so as to avoid removal of any of the treated surface wood. The brush and spray methods can be applied to wood after erection.

Investigations show that timber treated by these simple processes has given particularly good results in the roofs of paper mills and weaving sheds, where the high degree of humidity is conducive to decay. While the life of the best grades of untreated timber under such conditions is seldom more than nine years, and often only four years, roofs built of treated timber have



LOCOMOTIVE CRANE HANDLES LARGE TIMBERS AT TREATING TANK

been found in good condition after seven to nine years' service.

In one case the 2 x 6-in. white-pine roof covering of a paper-mill machine room built in 1900 was removed in 1908 on account of decay. It was replaced by douglas fir, and hot preservative was poured upon the finished roof, which was found to be in good condition eight

years later. In a similar machine room a roof sheathing of Norway pine, painted with white lead and oil on the inside, was removed in three years on account of decay. The new Norway pine roofing received two brush coats of coal-tar preservative before being set in place, and this roofing gave 14 years of service. A floor of brush-treated yellow pine, alternately wet and dry but protected from mechanical wear by steel plates, was in good condition after five years, although an untreated part of the floor had begun to fail from decay.

Where numerous low-priced dwellings are to be erected, as for workmen's houses or suburban development, it is claimed that timber treated by these simpler processes will prove economical, by permitting the use of cheaper and less durable kinds of lumber and reducing the cost of painting, since creosote applied as a preservative may serve also in place of paint or stain. For such work the open-tank process is considered desirable, the tank being installed on the site and the treated timber stacked to dry for a few days before being used, the time depending upon the atmospheric conditions. The treatment may be applied to all lumber used in the first-floor framing and porches, to the shingles and to the fence posts and boards.

Philippine Water-Supplies Get Strict Sanitary Supervision

Good Water Reduces Death Rate 50 Per Cent—Government Encourages Wells by Paying Two-Thirds Cost—Amoebæ Normally in Water Not Removed by Filtration but Not Disease Producers

By George W. Heise

Saltville, Va., formerly Chief of the Section of Water Analysis, Bureau of Science, Philippine Islands

BEFORE American occupation of the Philippine Islands a vast majority of the 8,000,000 inhabitants was dependent upon streams or shallow dug wells for its water-supply. Primitive methods of living and lack of sanitary facilities and sewerage systems made pollution of the supply inevitable, with detriment to the public health. Torrential rains of the wet season also caused periodical contamination, by washing débris into the water courses and wells. The only municipal system worthy of the name, that of the City of Manila (installed in 1882), derived its water from a river which drained a thickly inhabited watershed and was in effect the sewerage system for this area.

Spanish Efforts Not Successful

Attempts of the Spanish to secure potable water for towns located on mountain sides deserve mention. In these installations, some of which are still in use, water from springs located above the town was carried in open runways or ditches to the edge of the town, whence it was distributed through open laterals. As these ditches and laterals served as convenient places for washing clothes and as sewers (and in many cases are still used thus), these attempts to improve the water-supply could not be regarded as an unqualified success.

Even the water from sources of naturally potable supplies, such as certain springs, was frequently contaminated through careless handling and improper methods of storing. Under such conditions, it is hardly surprising that the Filipinos as a whole were weakened by disease, that dysentery and other intestinal illnesses were common, and that devastating epidemics of cholera occurred repeatedly. The state of affairs may be inferred from the fact that as late as 1909, after great improvements had been made, it was estimated that from 80 to 90% of the Filipinos were afflicted with intestinal parasites. In the low lands the temperature in general is over 85° F., rarely going above 90° or below 65, while the humidity is high. Temperature of surface water averages about 80 deg. Conditions are therefore relatively favorable for bacterial growth.

With the establishment of civil government, after the American occupation, much work was done in sanitation and the improvement of public water-supplies. The intimate connection between public health and the character of water was clearly demonstrated by the fact that in some localities the substitution of good water-supplies for the polluted sources previously in use led to a 50% reduction in the annual death rate. In Manila the installation of a new water-supply system was followed by a reduction of 66% in the annual deaths from intestinal diseases.

Construction of artesian wells was a most important factor in the improvement of existing water-supplies. Previous to American occupation there were two or three comparatively shallow flowing wells that had been constructed by the Spaniards. Drilling of artesian wells, begun by the insular Government in 1906, proceeded steadily until, at the end of 1917, about 1500 wells had been bored by the Bureau of Public Works, besides numerous wells constructed by private enterprise. For a period of years the annual Government expenditure for well drilling has been about $225,000. The drilling of wells was greatly stimulated by an act of the Philippine legislature, whereby the insular Government paid 66% of the cost of all successful wells, the municipality paying the balance, whereas the entire cost of an unsuccessful boring was borne by the Government. A well was considered unsuccessful if water was found in insufficient quantities or if analysis showed that it was not desirable for human consumption.

Water from Wells Is Satisfactory

Deep wells were generally properly constructed and tightly cased, with the tops embedded in cement. Their water, though frequently heavily mineralized, is bacterially pure and usually potable. Flowing wells are very common and are the most satisfactory, but unfortunately no attempt has been made to conserve the artesian supply, and some wells are already showing marked decrease in flow.

Deep pump wells are far less desirable. Great difficulty was experienced in securing a pump which would stand the service, as the local authorities, to

whom a well, on completion, was turned over by the insular Government, usually failed utterly to keep the equipment in repair. From personal observation in a number of provinces it may be stated that between 25% and 66% of the pumps were out of order or entirely inoperative all the time. Failure to drain waste water away from the well side, and use of dirty water for priming the pumps, served further to make the situation unsatisfactory.

Considerable progress was made in supplying towns with municipal water systems. In some of the larger installations (Manila, Cebu, Zamboanga) rivers from carefully guarded watersheds serve as a source of supply. In other cases springs or artesian wells are utilized. In one town, where the existing surface and underground supplies were not potable, a large rain-water cistern was constructed which supplies limited amounts of water for drinking purposes only. At the present time over 20 towns have water-supply systems in operation or under construction.

In none but the larger towns was any attempt made to supply individual houses with water. Even there the people in general were supplied, as in the smaller towns, from hydrants placed at intervals about the town, whence water was carried in 5-gal. gasoline cans, earthenware jars (ollas) or even in bamboo tubes.

The consumption per capita is relatively low, but this is of little significance in view of the scarcity of house connections and the general absence of sewerage systems. In Manila, which has the most elaborate system and where much water is used for industrial purposes, the average daily consumption is about 60 gal. per capita. In small towns, where potable water is the vital necessity, town projects have been based on an available supply as low as 10 gallons.

In only three towns is storage practiced on a large scale. As one of these has relatively small storage capacity and the other installations are comparatively recent, no great difficulties from stagnation have developed. In the isolated cases where disagreeable tastes and odors occurred, removal of the accumulations of sediment in the impounding reservoir was sufficient to restore normal conditions. Reservoirs usually must be abnormally large, since in many parts of the islands the rainfall, though high, is not distributed throughout the year, but occurs mainly during a period of about three months. Naturally, the water courses become greatly depleted during the dry season. The rainfall is 76.5 in. in Manila, on the island of Luzon, and two or three times as great in certain other islands.

Attempts to Purify Water

Some attempt has been made at water purification, principally on the Manila supply. This water is somewhat turbid and high in organic matter, and should be filtered and perhaps further purified. Sand filtration was proposed when the present system was being installed, until it was shown that amœbæ would grow through a filter. Although more recent study has shown that the omœbæ normally found in practically all tropical surface waters are not the kind that cause dysentery in man, the appropriation for an adequate filtration system has not been forthcoming. Copper-sulphate treatment was not deemed advisable, because of the excessive concentration (one part per 150,000) required to kill cholera vibrios. At the present time treatment with chloride of lime is practiced, but as the method of administration is crude and not very efficient, the water frequently acquires distinct odor and taste. Chlorination undoubtedly has effected a marked improvement in the water-supply, though the Americans, Europeans and wealthy native residents either boil the water before drinking, or, preferably, buy bottled distilled, artesian or spring water for table use.

Typhoid, dysentery and cholera are the principal water-borne diseases in the Philippines, but it is recognized that the organisms of these diseases are found in water only as the result of direct contamination. Accordingly, the best safeguards against infection are protection of the source, and measures to prevent careless handling of water after it is taken from the source.

Health Officials of the Islands

Progress has been due primarily to the coöperative efforts of three bureaus of the insular Government: Public Works, Health, and Science. The Bureau of Public Works has conducted the construction of artesian wells and water-supply systems. The Bureau of Health has established an organization which operates over the principal portion of the islands. Each province has a health officer and a corps of assistants whose work deals with matters pertaining to health and sanitation. In recent years this bureau has started a line of work which already has been productive of much good. This consists of the organization of "sanitary commissions," composed of sanitary engineers, bacteriologists, doctors and nurses. The work is intensive. A commission stays in a single town collecting vital statistics, establishing clinics and dispensaries, examining all available water-supplies and in general conducting a campaign of sanitation and education.

The Bureau of Science is the central scientific laboratory for all branches of the insular service. It has conducted the routine examinations, both chemical and biological, of sources of water, and has conducted medical surveys of certain districts with the coöperation of other bureaus. It tests every new artesian well and has conducted many investigations on water-supply problems in general.

Difficulties inherent in water examination are exaggerated in the tropics. Samples sent in for analysis are often taken improperly and are unaccompanied by necessary data concerning the source, while, owing to the climate and to difficulties of transportation, they rarely reach the central laboratory in proper condition for examination. European or American standards are of little value. The writer virtually abandoned nitrogen determinations in chemical water analysis. Colony counts on plain agar; presumptive and, if necessary, confirmatory tests for b. coli. and a test for protozoa served for the routine biological examinations. The organism of dysentery is not readily detected, and the presence of amœbæ in surface water is of little significance, as noted above.

For a field survey undertaken by the Bureau of Sience a field laboratory was devised, patterned after that of the United States Geological Survey, with which it was possible to make both chemical and bacteriological

examinations. Though lacking the refinements of laboratory analyses, the field examinations gave results superior to those usually obtained in the central laboratory, since field methods were sufficiently accurate for ordinary purposes; and as the analyst obtained his own sample he could make valuable observations regarding the nature of the source.

The water-supply situation is still very unsatisfactory, in spite of the progress which has been made. Ignorance of the first principles of sanitation, superstition regarding the use of artesian well water, and unwillingness to abandon unsafe surface supplies, are some of the unfavorable factors. Surface wells still furnish a large part of the water used for domestic purposes, although examination has shown practically all these sources to be dangerously contaminated. The average surface well is close to human habitations and is open and unprotected. Water is obtained by dipping, frequently with dirty vessels. Clothes are washed at the well side, and animals are allowed in the immediate vicinity.

In six typical towns studied by a sanitary commission only 2% of the homes were supplied with privies, of which 10% were flush closets. More than 95% of the inhabitants of these towns have been found to be infected with intestinal parasites. One of the larger cities, with a population of 50,000, is still unsupplied with a municipal water or sewerage system, although practically all available sources in that locality are unpalatable or dangerous.

The outlook for improvement of sanitary conditions is none too favorable. Capable men have not been encouraged to remain in the service, and in a large number of instances their places have been filled with comparatively untrained natives. However, the foundation for good work has been laid, much gratifying progress has been made, and it is to be hoped that further improvements will come.

Comparison of Railroad Terminal Projects at Cleveland

Relative Advantages of Lake-Front Project Decided Upon Some Years Ago and Public-Square Location Approved by Recent Vote, as Seen by Various Engineers

TWO rival railroad-terminal projects have been under discussion in Cleveland for many months past. By vote of the people Jan. 6 one of the projects was ostensibly adopted, but there remain so many legal and financial details to be settled before the project is finally approved that a résumé of the two projects, purely as solutions of a railroad-terminal problem, seems worth while.

In 1915 contracts authorized by vote of the City of Cleveland were entered into between the city and the New York Central, the Pennsylvania, the Cleveland & Pittsburgh and the Big Four R.Rs., whereby these railroads agreed to build a union station on the lake front forming the northerly end of the elaborate public-building group which had been started by studies in 1903. Various agreements as to exchange of property and improvement costs were fixed in the contract, which further stipulated that actual work should begin within six months after the deeds to the property had been delivered. Such delivery has never been made. In 1912 the Cleveland & Youngstown R.R. was empowered by the city council to operate a railroad across certain streets in Cleveland, and in 1917 this railroad, together with the Wheeling & Lake Erie, the Erie, the Baltimore & Ohio, and the Nickel Plate, which latter had been purchased by the Cleveland & Youngstown, prepared plans for a stub-end passenger station on the Cuyahoga River Valley just south and west of the Public Square. Early in 1918 these plans were submitted to the United States Railroad Administration. In the discussion which followed it was suggested by the regional director that the plans be changed from a stub-end to a through passenger station, to be used by all the railroads entering the city. On Aug. 17, 1918, the plan and report were adopted by the representatives of the seven railroads interested, which include the railroads which had hitherto agreed to build a union station on the lake front. A company was therefore organized, known as the Cleveland Union Terminals Co., to build the union station on the Public Square, and an ordinance was adopted by the city council and approved Jan. 6, by a vote of 31,000 to 20,000 (as noted in *Engineering News-Record* of Jan. 16, p. 165), authorized its construction.

Previous to the vote Jan. 6, however, a lively controversy arose in the city as to the desirability of the two sites, and the Chamber of Commerce retained Lieut. Col. Bion J. Arnold to report on their relative advantages. Following Colonel Arnold's report a statement was made by W. E. Pease, engineer for the Cleveland Union Terminals Co., and by the Board of Supervision for Public Buildings and Grounds, which is the body having control of the public-building group plan for which Cleveland has become so noted. All of these reports have been made up by the Cleveland Chamber of Commerce under one cover, and they give a very clear exposition of a difficult problem, and one which by no means is settled by the recent vote.

The three maps given herewith show the present and prospective railway terminal situations. One map gives the present location of lines entering the city; the second, the proposed lake-front union-station scheme, and the third, the proposed Public-Square union-station plan. The lake-front scheme retains the present lake-shore lines in approximately their present location, but provides for expansion, as noted in Colonel Arnold's report. In the original scheme, some other arrangement of terminals had to be provided for all the railroads now entering the city from the south, but the drawing gives the possible entrance of the Cleveland & Youngstown and other lines via the Cuyahoga Valley.

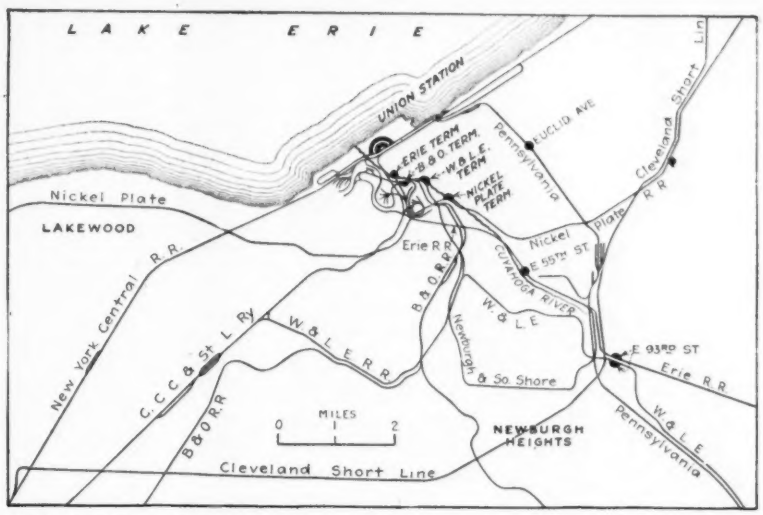
The plaza scheme involves the construction of a through passenger station southwest of the Public

Square, with railroads entering via the Cuyahoga Valley. Provision is made for two train levels in the station, the upper level to be used for express and limited train service, and the lower level for suburban and local trains. Interurban tracks would also be laid alongside of the main-line tracks, thus removing a number of present tracks from the city streets. Provision is furthermore made for a subway connection to the Public Square, in which now all the city's trolleys center. Behind the main passenger station there would be laid out a number of freight terminals, with adjacent warehouses. The present lake-shore roads would have to be relocated as shown on the map in order to bring their passenger traffic into the city via the valley, retaining the shore line for freight use.

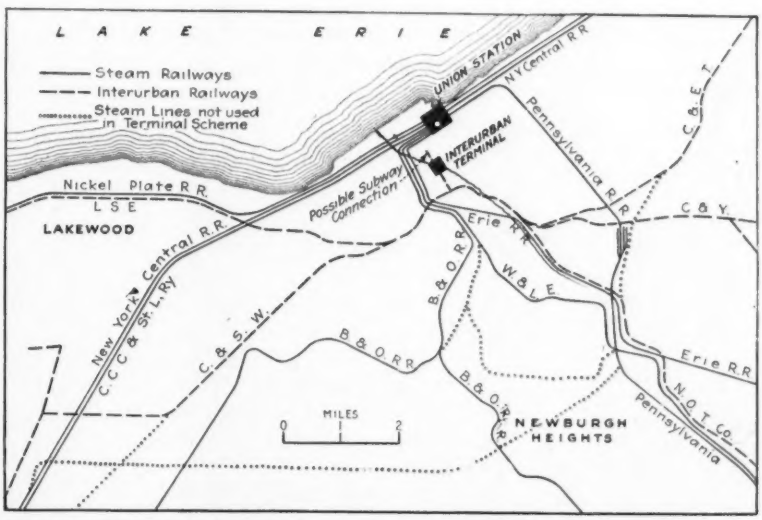
Five terminal stations now existing would be consolidated into one union station, in either case. Of these five, the largest is the old lake-front union station, used by the Pennsylvania and the New York Central lines. This, according to report, handles 85% of the total ticket sales and 66% of the daily total of 156 trains. Only 36 of these trains pass the most congested part of the New York Central main line, noted below. The other terminal stations are those of the Erie, the Baltimore & Ohio, the Wheeling & Lake Erie and the New York, Chicago & St. Louis.

A straight and direct route for the principal lines is provided by the lake-front site, with other lines coming in from the side, along the Cuyahoga Valley. The Public-Square site, however, necessitates approach by a sinuous location, with the union station placed at the apex of a V, so that entrance curves at each end are unavoidable. Interurban lines by this latter project would be transferred from streets and highways to the railways' right-of-way and brought into the lower level of the station.

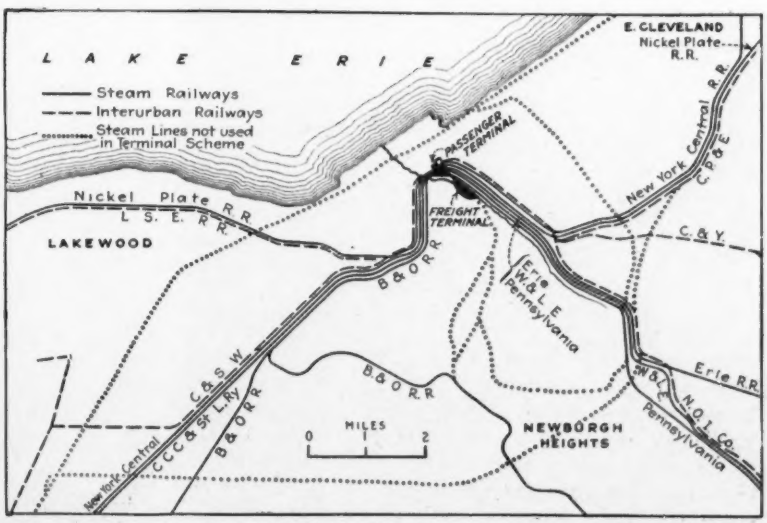
The main conclusion of Colonel Arnold's report is that the whole subject should be thrown open to further study. Three subjects submitted to him as the basis of his report were as follows: A comparison of the two projects; the possibilities of developing the lake-front site to meet the future requirements of the city; and the likelihood that the Public-Square project would cause extreme traffic congestion on the square. Comparison of



PRESENT RAILWAY SYSTEM OF CLEVELAND, OHIO, HAS FIVE TERMINAL STATIONS



MAP SHOWS POSSIBILITIES OF ACCOMMODATING ALL LINES AT A UNION STATION ON THE LAKE FRONT



MAP SHOWS PROJECT FOR DIVERTING ALL LINES TO A CENTRAL UNION STATION ON THE PUBLIC SQUARE

the projects is made on their merits, and does not include estimates of cost, although it is shown that very high cost of land is involved in the central project.

Reconstruction of a lake-front union station to accommodate not only the roads now using this site, but all the steam railways entering Cleveland, is recommended on account of the possibilities of readjustment of freight and passenger terminals, the space available and the general facility of access. Conditions of grades and topography favor such development at minimum capital expenditure.

Terminal development at the lake front could proceed even now on a temporary two-level plan, as pointed out by Colonel Arnold, the present roads on this location using the permanent upper level and the roads coming in along the Cuyahoga Valley occupying the lower level. If electrification were feasible immediately the lower lines could be placed beneath the upper deck, but, failing this, they would be operated alongside of the high-level lines. When the Cuyahoga River is straightened, as now proposed, the Big Four trunk-line entrance through the valley would be elevated, all main lines then using the upper level of the station and the lower lines being reserved for service tracks or other purposes.

Lake-Front and Central Sites Are Compared

Critical comparison of the two sites is given in some detail in Colonel Arnold's report. Area available for development at the lake front is practically unlimited. Plans for the Public-Square site provide for 24 tracks ultimately, which in the author's opinion represents the limit of possibility at this site for steam-railway purposes. He considers this sufficient for 15 or 20 years, provided that extensive commuter traffic does not develop as in New York, Chicago, Pittsburgh and other cities. From his investigations, however, it seems possible that such traffic may develop in Cleveland to the extent of requiring at least half of the station capacity during the rush hours. With the Public-Square station admitting of no further expansion, the only remedy would be to utilize some of its tracks on the lower deck, provided that the electric interurban traffic on this deck could be handled in less space than originally intended for that purpose.

Sharply curved entrances form a distinctly unfortunate feature of the Public-Square site, but are unavoidable here on account of the location. Thus, while the average platform length is about 1000 ft. (13 cars) the average length on tangent is only 600 ft. (eight cars). There is no such limitation at the lake-front site, which is on a straight line.

Cost of the Public-Square station is bound to be very high for the amount of trackage available, in Colonel Arnold's opinion, owing not only to the high commercial value of the land, but also to street reconstruction and the demolition of existing structures. In fact, nearly half the cost of this terminal appears to be in land and right-of-way. Most of the land required for the lake-front site is owned by the railways, and the balance can be acquired at a very low rate, compared with the other project, so that, Colonel Arnold estimates, the total cost of site might not exceed 25 or 20% of that of the Public-Square site.

Approaches and grades also appear decidedly favorable to the lake-front site, as the location is straight and the present maximum grade of 0.75% for five miles west of the river could be reduced to 0.56% for at least 1¼ miles. The other location is sharply curved, and would have short grades of 1.1% on the east and 0.72% on the west approach. Furthermore, the latter would require expensive grade improvement on the east and a long cut on the west about 45 ft. deep, with a ¾-mile viaduct across the valley.

Rerouting of trains would enable the present New York Central main line on the lake front to accommodate through traffic for some time. Both projects provide for four-track approaches at present, with a future increase to six tracks.

Obstruction to the above New York Central main line, due to certain yards and industries, which obstruction has been emphasized as a serious objection, is only a temporary difficulty and can be remedied, according to Colonel Arnold. He shows that removal of the yards in question is proposed already, while the city's policy of encouraging industries to transfer to points where ample space is available at low cost will result in relieving this part of the congestion automatically.

In facility of access for the public the Public-Square site has an advantage as long as this point remains as the commercial center. But eastward extension of the retail business section seems probable, according to the report, so that this advantage might be reduced in the future. Establishment of through lines of surface and subway local transit might place the lake-front site relatively at a disadvantage, but Colonel Arnold points out that frequent station service can be established, and that while concentration of local transit service at a large railway station is primarily desirable it often produces undesirable results. The lake-front site has the advantage of numerous wide streets, as compared with the cramped and detoured street system proposed around the Public-Square station. It is urged that subsurface levels for this latter station should not be developed without full consideration of the possibilities of future rapid-transit subway development, to which such station sublevels might be an obstruction if not planned with such subways in view.

Electrification of Prime Importance

Electrification is of maximum importance in the Public-Square project, because of high-grade commercial property in proximity to the parking space for the locomotives. It is imperative, in fact, on account of the proposed development of buildings over the station site. This condition does not affect the lake-front site, although Colonel Arnold points out that the station should be designed with a view to future electrification. Location of coach yards and engine terminals is favorable to the lake-front site, as in the other case these facilities would be from two to five miles distant, necessitating considerable dead mileage.

For through-freight service Colonel Arnold suggests two alternative high-level, low-grade routes, independent of the New York Central main line on the lake front and requiring but little construction work. This, he considers, would give a better balance of traffic than the diversion of all passenger traffic from the direct

lake-front route to the circuitous route leading to a central station, and of all eastbound freight traffic to the existing belt line.

The freight-terminal facilities as provided by the Public-Square project are unsatisfactory in their relation to the city, in Colonel Arnold's opinion. While the terminal itself is well planned, it gives undue concentration at a point where only a few thoroughfares are available for distributing the team traffic. It would involve a large amount of trucking across the retail district to the warehouse and wholesale district, while all the trucking to and from a yard handling 500 to 1000 cars daily must concentrate at the only viaduct connecting the east and south sides. At the lake-front site, freight-house and team-track facilities of ample capacity can be provided at such elevation as to reach the streets by grades of 3.5 to 3.7 per cent. This location also would avoid trucking across the retail district.

Facilities for interurban package freight are recommended in the report. In the Public-Square project some provision is made for handling farm products on the lower deck of the passenger station, but Colonel Arnold considers that good facilities for handling electric freight and express matter at the freight houses should be provided, in order to remove traffic from the most congested point of the downtown streets.

The removal of electric interurban traffic from streets and highways is provided in the Public-Square project, to the extent of 46 miles within the city limits and 60 miles within the Cleveland district, but this will require the construction of about 13 miles of new line for the necessary connections. While this is advantageous to the city, according to Colonel Arnold, the cost to the electric lines in traffic readjustment, new track-entrance facilities and cost of terminal service appears to be indefinite. Ability of the interurban lines to pay their share of the cost is questioned.

Under the lake-front plan the interurban lines would have to be accommodated in a separate terminal (as originally considered in the Cleveland & Youngstown ordinance), connecting with a possible future subway in the Public Square. Colonel Arnold suggests that they might be accommodated at considerably less expense in a double-deck terminal occupying about the site of the present station of the Wheeling & Lake Erie Railroad.

Congestion of Street Traffic

Serious traffic congestion in the Public Square and adjacent thoroughfares, without rapid-transit subways, would result from the establishment of a single union railway terminal at this point, in Colonel Arnold's opinion. Eventually such a concentration of railway, interurban and local traffic would necessitate three successive developments: The rerouting of surface cars; the provision of rapid-transit subways and connecting viaducts across the Cuyahoga Valley to relieve and by-pass the Public Square traffic; and, very probably, the construction of a second union station on some other site to accommodate the long-haul steam traffic crowded out by the growth of suburban electric traffic.

In giving this opinion, Colonel Arnold considers the desirability of decentralizing intensive commercial development in accordance with modern city-planning movements. He considers also "such inefficient and improper concentration" as has occurred in the downtown districts of New York, Chicago and other cities. While various expedients might be provided to relieve the congestion, they can be regarded only as temporary, even with lavish expenditure of capital and engineering skill.

Viewed broadly, says Colonel Arnold, the question of congestion calls for a distinctly unfavorable reply if transit development is to continue along present lines. The reply can be favorable only if extensive capital investment is assumed to be forthcoming for such complementary undertakings as subways and viaducts. Construction of such works would be imposed upon the city, and would not be a part of the terminal project.

Contentions of Union Station Advocates

About the time when Colonel Arnold's report was made, the Board of Supervision for Public Buildings and Grounds made a report to the Chamber of Commerce in which it urged strongly that further consideration of the proposed lake-shore project be given. It is the feeling of this board that the removal of the railway station from the lake-shore end of the Mall will be a serious detriment to the proper development of the new building plan, and would, in addition, force upon the city the financial obligation of supplying something to take the place of the station, which was a necessary architectural feature of the group.

In partial answer to the Board of Supervision and to Colonel Arnold, the Cleveland Union Terminals Co. says that the original scheme for the group plan did not include a railway station at the lake end of the Mall, and that the station was placed there only after it was thought there was no other place for it. The terminals company passes over Colonel Arnold's report with the mere statement that it must be an academic dissertation upon the comparative merits of the two projects, because of his admited failure, for want of time, to make the preliminary studies of the problem which he states are so vitally necessary. The company asserts that the union terminal would reduce the average running time of the suburban roads entering the city at least 30 min. and remove the suburban cars from the city streets. It would (1) provide Cleveland with the advantages of commuter service; (2) wipe out the bad architectural conditions existing on the south side of the Public Square; (3) provide a magnificent architectural development, involving perhaps in its ultimate cost an expenditure of $50,000,000, and (4) remove from the group plan a building to which its originators earnestly objected at the start, and render the Plaza or Mall available for more appropriate architectural treatment.

Road Engineers Will Be Wanted in Alabama

An insufficient supply of field engineers has hampered the supervision of road work by the Alabama State Highway Commission. In its latest annual report, dated Nov. 2, 1918, the commission states that with the steady increase of Federal-aid work it will be absolutely necessary to have additional engineering assistance, to keep faith with the United States Government by seeing that this work is executed properly.

Design and Operation of Fort Myer Sewage-Treatment Plant

Pioneer Among Standard Camp Sewage-Works Consists of One-Story Tank, Dosing Chamber and Sprinkling Filters—Low First Costs—Produces Good Effluent

By Leonard S. Doten
Major, Quartermaster Corps, Sanitation Section, Engineering Branch, Construction Division of the Army, War Department, Washington, D. C.

THE officers' training camp at Fort Myer, Virginia, was one of the first military camps constructed by the War Department following the declaration of war. As constructed this camp had a capacity of 2500 men. Work was started in the latter part of April, 1917, and completed on May 14.

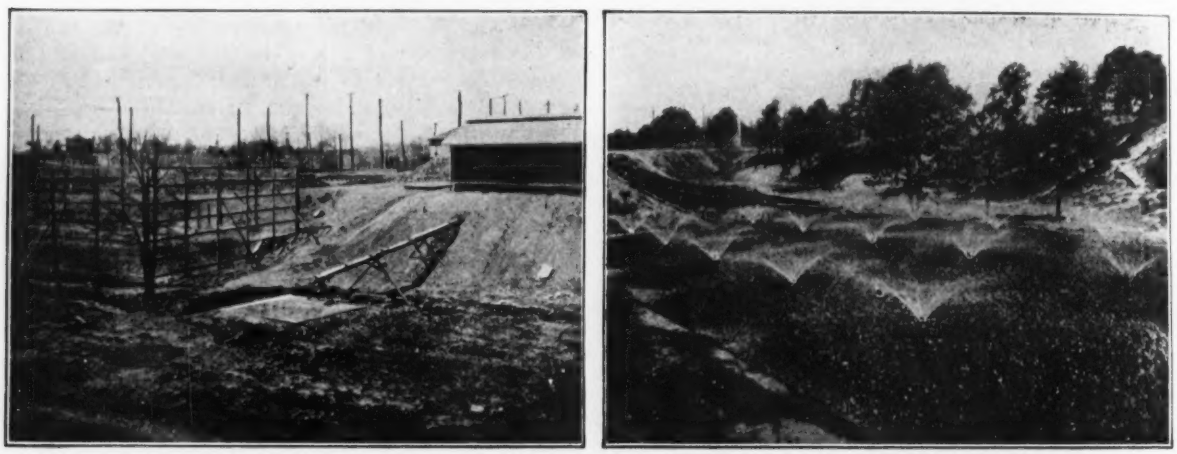
The writer was called upon to design a complete water-carriage sewerage system for this camp. The conclusion was soon reached, after an investigation of conditions at the camp site, that to dispose of the sewage adequately it would be necessary to construct either a pumping station with a long force main, or a sewage-treatment plant. Owing to the fact that the time was limited for completing the system, and in consideration of the difficulty of obtaining suitable pumping equipment, it was decided to construct a sewage-treatment plant near the southern limit of the camp, and to discharge the effluent therefrom into a small watercourse leading away from the camp site. The sewers and treatment works were built in about three weeks and put in operation on May 14, 1917, the date of opening the camp.

The treatment works consist of a settling and sludge-digestion tank, a siphon chamber and a sprinkling filter. The design of the tank was somewhat similar to that of several tanks which had previously been designed by the writer for military post purposes, but was much simpler in details of construction. It has a gross capacity of 26,000 gal., and is divided into three compartments of equal size. The baffles are much deeper than were those used in previous designs. The filter is 5 ft. deep and has an effective area of approximately 3000 square feet.

The entire plant was designed on the most economical lines possible. Many features which had previously been considered essential by the writer and other designing engineers for municipal plants were omitted. All filter cross-sections were identical, and the concrete in the retaining walls and the underdrainage was reduced to a minimum. Advantage was also taken of the conformation of the site to reduce the amount of excavation to the lowest possible limit. The plant, which was designed for a population of about 2000, cost only some $8000, although crushed rock delivered at the site cost $3.10 per cubic yard.

Soon after the completion of this plant the writer prepared typical drawings for sewage-treatment plants suitable for camps accommodating from one regiment to a division. The designs were similar to that of the Fort Myer plant, except certain details of baffles. Later, when the Cantonment Division (now the Construction Division) was organized, and the writer was placed in charge of sewerage work, this type of plant was adopted as the standard for use at all cantonments and camps. Carefully prepared estimates of the cost of tanks showed a great saving in cost of construction over Imhoff tanks of equal capacity, the average cost being approximately one-third that of the latter type. Another factor of great importance was the time saved in construction. Furthermore, it had the advantage of being simpler to operate than the deep separate digestion-chamber type and more suitable for handling the sewage, which was fresh and uncomminuted and therefore characteristic of camp and institutional sewage.

It has been the established practice of the Construction Division since April, 1918, to install large grease traps of special design on all kitchen sewer connections in new camps, and to replace with the same the small, vitrified-clay traps originally installed in old



THE COVERED SETTLING TANK IS ABOVE AND NEAR THE WIRE-FENCED SPRINKLING FILTER

camps. The Fort Myer system was equipped with these traps this season. As a result, the grease load on the sewage-disposal plant has been greatly lessened, giving the plant additional capacity.

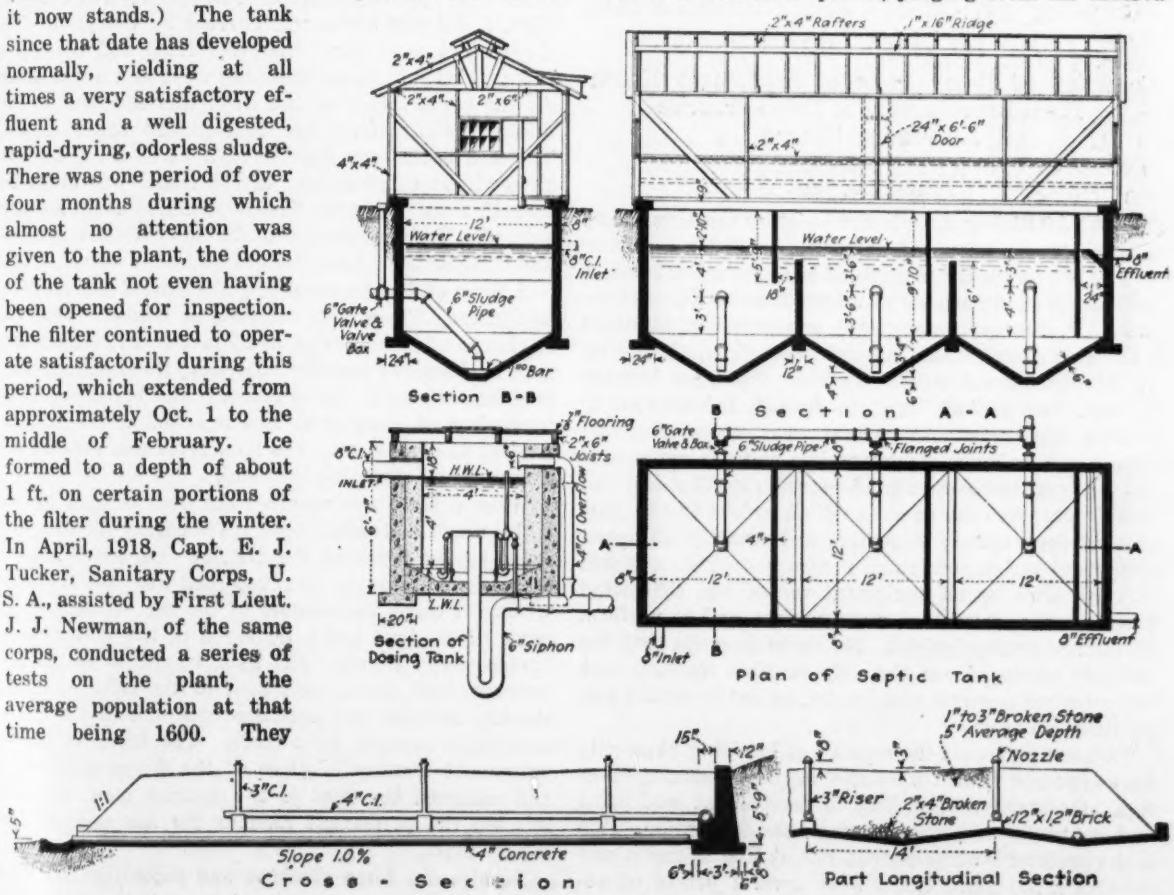
The new grease traps have a capacity of approximately two-thirds of a gallon per capita and are designed to avoid as far as possible the retention of settleable solids. It has been found possible to recover grease ranging in amount from 50 to 75 lb. per company per week. It is estimated that the grease recovered by means of these traps will be over 12 lb. per man per year. At the present time, this grease is being rendered and made into soap for camp use. At the cantonments, grease and many other wastes are sold under contract.

The plant has been in continuous operation since its completion, handling the sewage from a population generally ranging from about 1500 to 2200.

Although located only about 150 ft. from the nearest barracks building and a little over 100 ft. from a small railway station, no nuisance has resulted. The tank was slow in "ripening," due undoubtedly to the large amount of grease which was later found to be characteristic of the sewage at the cantonments. As a result of this, it was found necessary, about four months after the tank was placed in commission, to remove a part of the accumulated solids in the first compartment and to make certain structural alterations in the tank. (The sections shown herewith represent the tank as it now stands.) The tank since that date has developed normally, yielding at all times a very satisfactory effluent and a well digested, rapid-drying, odorless sludge. There was one period of over four months during which almost no attention was given to the plant, the doors of the tank not even having been opened for inspection. The filter continued to operate satisfactorily during this period, which extended from approximately Oct. 1 to the middle of February. Ice formed to a depth of about 1 ft. on certain portions of the filter during the winter. In April, 1918, Capt. E. J. Tucker, Sanitary Corps, U. S. A., assisted by First Lieut. J. J. Newman, of the same corps, conducted a series of tests on the plant, the average population at that time being 1600. They made analyses of raw sewage, tank effluent and filter effluent. The tests were continued from April 18 to 24, inclusive. The data thus obtained confirmed the writer's opinion relative to the excessive quantities of grease carried in cantonment sewage. It also showed that the sewage contained much larger quantities of suspended organic matter than had previously been supposed. It was found that the average sewage flow was approximately 47 gal. per capita per day. The average grease content, as shown by these tests, was about 115 ppm.; total solids, 1169; suspended organic matter, 571. Although the average detention period was approximately 4½ hours, 72% of all suspended organic matter was removed by the tank. The filter yielded a uniformly satisfactory effluent, although operating most of the time at the rate of 30,000 population per acre.

During the present season numerous putrescibility tests of the effluent have shown it to be absolutely stable at all times and extremely low in turbidity. The excellent quality of the final effluent is attributed to the good quality of the tank effluent, and to the method of dosing the filter. The volume of effluent is usually four or five times the flow of the stream into which it discharges. At no time has there been any objectionable odor or any appearance of putrefaction in the stream. The stream bed is absolutely free from all indications of organic growths characteristic of sewage-polluted water.

It is the writer's opinion, judging from his observa-



THE PLANT CONSISTS OF A ONE-STORY EPTIC TANK, DOSING CHAMBER AND SPRINKLING FILTER

tions of the working of municipal plants, that many plants in this country could be greatly benefited by the adoption of the short-cycle scheme of dosing. The practice, which is common, of constructing deep filters, and assuming the capacity to be in direct proportion to volume irrespective of the depth of the filtering material, is not consistent with the writer's experience. A filter of 4- or 5-ft. depth may be so designed and operated as to secure more perfect nitrification if operated at a rate of not to exceed 2,000,000 gal. per acre per day than can be obtained by the use of filters ranging in depth from 6 to 10 ft., as usually operated.

The sludge at Fort Myer is of unusually good quality, being thoroughly digested, as is evidenced by the fact that it dries rapidly. It is free from odor, does not attract flies, and is alkaline in reaction. All sludge has been disposed of by discharging it into shallow trenches excavated in the low ground near the plant. It dries quickly, notwithstanding the denseness of the soil and other unfavorable conditions.

During the period of maximum population the tank has a gross holding capacity of approximately 12 gal. per capita, and during the period of minimum population about 17 gal. per capita. The first compartment might be termed the "seeding" chamber, the second compartment the digestion chamber, and the third compartment digestion and sedimentation. Scum forms in a heavy mass in the first compartment, also of considerable depth in the second, and very lightly in the third. The action which takes place in the tank may be described as that of "division and transfer." The partially disintegrated matter in the first compartment is carried into the second compartment by the velocity resulting from the limited space between the scum and the sludge, and in the second compartment is again split up into a more finely divided condition. The finer particles are carried into the third compartment, where further division and sedimentation take place.

The effluent resulting from this action is in a better condition for oxidation in the sprinkling filter than that resulting from plain sedimentation, as nearly all of the matter carried in suspension is in a mineralized state. Analyses show that the nitrification is practically complete, and the effluent as it leaves the filter contains an unusually high percentage of dissolved oxygen.

Although complete data have not yet been received from many of the later plants of this type, it is anticipated that equally good results will be obtained as soon as sufficient time has elapsed for the tanks and filters to become thoroughly "ripened."

Keeping Track of Construction Plant at Hog Island

Condition of Every Piece of Equipment Known From Records Revised Daily—Precise Accounting System

By R. E. Roesler
Philadelphia, Penn.

MANAGERS and engineers building the Hog Island shipyards knew the character, condition and location of the hundreds of items of equipment employed as well as the good business man knows the contents of his desk. A highly systematized equipment department made this practicable. Summarized briefly, the duties of this department were: To know the exact location of each item at any time; to furnish information to various departments in various ways, concerning any equipment; to know what was idle and the reason for the idleness; to have on hand special, classified and full inventories; to pass on or void all orders to the purchasing department; to receive and identify all accessories and assign permanent numbers; to keep a record of work done by all equipment rented and contracted for; to anticipate future requirements, and to perform all clerical work required. No claim is made that the methods employed are the only possible methods, but the principle is sound and can be applied to almost any construction work.

Physical control is the manner of handling *physically* all equipment from its receipt until it becomes obsolete. Ordinarily, equipment is received at one point and can be passed through a single service station. This is the preferable arrangement, but at Hog Island it was impracticable, since there were several points of receipt.

An area approximately three miles long and one mile wide, about 900 acres, was covered by the yard. The three miles were along the river front and this front was divided into 50 shipbuilding ways and a wet basin. As the construction of the ways was assigned to five different contractors, five construction zones existed. The wet basin was considered a sixth zone, and the strip at the extreme rear of the island was made the seventh zone. Only the five construction zones are considered. Each of these was divided into five districts and these districts were designated by the letters A to Z.

A force of 35 men checked and reported receipt of all equipment. These were assigned as follows: One man in charge of each district, or 25 men in all; a zone foreman in charge of each five districts; three general foremen supervising the zone foremen and reporting to the supervisor of equipment, who reported to the superintendent of equipment. The total force was thus 35 men checking and reporting material.

When a piece was received the district man marked it, by brush and paint, with a temporary number, preceded by the letter of the district. On his list, under the assigned mark, he then recorded what the item was, whence it came, the number of the car or truck or the name of the boat which delivered it, the shop number, horsepower, size, etc. His lists, turned in to the zone foreman each night, were sent to the office and there checked up with the purchase orders, and the proper accounting records were made. The office assigned a permanent number in place of the temporary number and returned the lists to the district man, who substituted the permanent number for his original temporary mark.

Besides the force checking and recording receipt as described, there was a force of yard men, under the

storage yard man, who collected all available equipment, placed it in the storage yard, had it repaired if necessary, and thus kept the jobs clean of all idle equipment. These men increased the yard force to 75 men.

To control the activities of the yard forces, the office was divided into six departments:

1. The order department, which took care of all requisitions, purchase orders, expediting, and order and correlated files.
2. The receiving department, which looked after equipment received, identifications, special reports, permanent numbers and assignments.
3. The transfer department, which looked after all equipment in use, and kept a record of all transfers made, all available equipment reported and all reported for repairs.
4. The rental and contract department, which kept track of the receipt, identification, transfer, working records and return shipments of all equipment rented or contracted for.
5. The locomotive-crane department, which kept track of all locomotive cranes, recording work done, shut-downs, etc.
6. The inventory department, which made periodical statements.

In addition to these primary departments, there were an expediting and a car-record division and a filing department. The car-record division prepared the records for tabulating the information needed when cars arrived in the yard. By the work of the expediting division an effort was made to follow up the orders for equipment, from the time it was ordered until it was received, so that the status of any shipment could be known at any time. The duties of the filing department were to collect and deliver work and look after office equipment and supplies.

Clerks were assigned to the several departments according to their relative volumes of work. Each department force was headed by a "leader." The office was then divided into three divisions, with a chief clerk over each, to whom the leaders in his division looked for orders. The chief clerks reported to the superintendent of records, who in turn reported to the superintendent of equipment. When the work had been fully organized and the men had become trained, an office force of 80 men handled everything efficiently. This force added to the yard force of 75 men made an equipment organization of 155 men.

Accounting Separated Into Two Operations

Accounting consisted of two distinct tasks: (1) Accounting for equipment ordered, and (2) accounting for equipment received.

When equipment was ordered a requisition was issued by the stores department, after approval by the superintendent of equipment, on the purchasing department. One copy of this document was sent to the party initiating the order, one to the equipment department and one to the purchasing department. On receipt of its copy of the requisition, the equipment department made two copies for filing, one according to number and one according to classification. As soon as the purchasing department placed the order a copy of the purchase order was sent to the equipment department, which made six copies, one for each of the office divisions except the locomotive-crane division. Each division handled and filed its order according to its own particular needs; the procedure will be outlined very briefly.

In the order division, after checking the purchase order against requisitions, the order went to the numerical file clerk, who made out a sheet for each item and filed these sheets numerically; then to the ledger record clerk, and finally to the correlated file clerk, who entered the items on sheets which he filed according to classification. The receiving division received two copies of the purchase order and filed one according to classification of equipment and the other according to classification of shippers. The inventory department used its copy of the purchase order to check against equipment receipts.

Card Has Complete Record of Each Item

The work of the transfer department began by making up a transfer record card for each item shown on the purchase order. The transfer record card carried more or less complete information of each item, with additional columns for transfers to and from. These cards were filed according to the division of the yard—that is, by zones, districts, etc. A separate file was also kept for all equipment reported available or in repair shops, or obsolete. On receipt by the rental and contract department of its copies of these purchase orders they were separated and filed according to orders issued for contracts or orders for equipment rented or bought outright. Entries were also made on loose-leaf forms devised for the purpose of keeping each contractor's equipment separate. Entries were also made for equipment under contract and rented, on working records, giving a daily tally of the work done, the hours worked, the causes of shut-downs, etc. In this way a record was kept of performance, according to classification and according to contract.

No purchase orders went to the locomotive-crane department, as the work of this department consisted mostly of keeping records of crane performance. Requisitions for crane work went to this department, and cranes were assigned. A work-order card went with each crane assigned; on this card the engineman recorded his time, returning the card to the office when the work was finished. About 30 cranes were in use, and by this system a record was available, at any time, of the work done by any crane.

Methods of accounting on orders only have been considered in the preceding description. On receipt of the equipment another set of accounting operations ensued. As previously described, the yard man turned in daily lists of equipment received. These receipts were registered on the equipment register and the lists were then checked against purchase orders. The original as returned to the yard, and a copy was sent to the record division, where proper notations were made on the various records. In turn the list went to the transfer and inventory departments, and, so far as equipment contracted for or rented was concerned, to the rental and contract departments, for the various records which they kept.

Chicago Water-Works Intake Crib Tilted Level With Screw Jacks

Lopsided Appearance of New Superstructure Corrected by Unique Engineering Operation—Instrumentman on Center Tower Controlled Moves by Means of Twenty-Four Leveling Targets

TILTED 18 in. out of level, the 1400-ton ashlar masonry ring forming the superstructure of Chicago's newest water-intake crib was recently blasted loose from its base, mounted on 300 jacks and restored to level partly by blocking up and partly by revolution. Using light charges of dynamite, a ring of concrete was removed from its place directly under the lower course of masonry. Only one stone in the entire 70-ft. ring was cracked. Expert housemovers operated the jacks, tilting the ring a fraction of an inch at a time, while an instrumentman checked each change of level and gave the foreman of the jacking crew the data by which he controlled the operations of his jackmen. Thirty days was the elapsed time from the start of operations to the finish of the underpinning. Scarcely a crack or an appreciably open joint was visible when the work was completed.

CONCRETE BLASTED OUT IN SECTIONS REPLACED BY SCREW JACKS

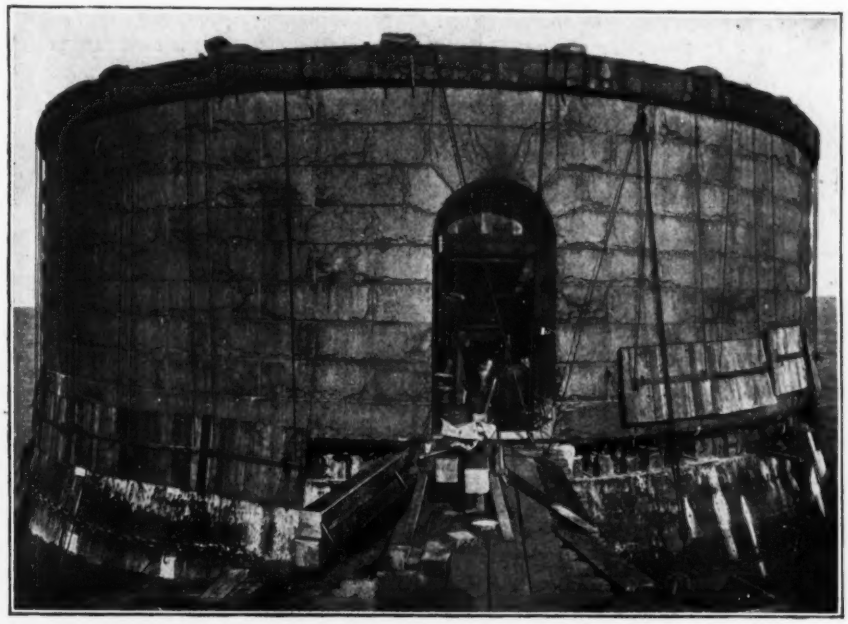
A—Inclined struts set on screw jacks prevented lateral movement of masonry ring. B—Bracing between inner and outer steel shells of caisson. Three rows of jacks set under masonry ring—concrete blasted out to cut ring loose.

Construction of the Wilson Ave. intake crib involved first the sinking of a caisson consisting of two concentric steel cylinders filled between with concrete, as described in *Engineering Record* of Jan. 23, 1915, p. 104. This caisson had an outside diameter of 70 ft. at the top and 90 ft. at the bottom. The inside diameter was 40 ft. On top of the caisson was erected a granite ashlar ring 70 ft. in outside diameter. Inside the caisson is the downtake shaft capped with screens and inside the granite walls is the housing for the crib tender and the appurtenances for crib operation.

In the sinking of the caisson it tilted about 16 in. out of level, presumably because of varying density of the clay subsoil. This occasioned no concern, and after the inclined top was leveled up with concrete the masonry ring was built. Shaft sinking was then begun by the contractor inside the pumped-out caisson. This shaft was constructed by sinking cast-iron lining rings for a portion of its depth. Below this lining the usual wooden curbing was employed. The sides of the shaft swelled, and considerable more material was excavated than the volume of the shaft called for. When the shaft had been completed, it was discovered that the caisson had again tilted so that the top of the masonry ring was 18 in. out of level. It was decided to rectify the position of the masonry ring. Two methods of procedure were possible. One was to take down and reconstruct the ring after leveling up the caisson top with concrete; the other was to cut the masonry loose from its base, level it up and underpin it. The second procedure was adopted. It was also decided not to raise the low side the whole distance BE, as indicated by the sketch, but to revolve it on the axis YY so as to lower the high side from A to C and elevate the low edge from B to D.

To loosen the masonry from its concrete seat and to provide space for the jacks by which it was to be tilted level, a ring of concrete had to be cut out entirely around the crib. Blasting was the method adopted. As shown by the lettered view, this blasting had to be performed between the braces tying the inner and outer steel shells, and, of course, underneath the masonry ring, and it had to be performed so carefully that the masonry should not be cracked and the outer steel shell should not be broken through. The procedure was as indicated by the sketch. Between two sets of shell braces OG and OH, blasting under the ring was begun by drilling holes ba and ca and taking out a wedge cut. This cut was enlarged by removing wedges 2 and 2, and then three jacks were set and screwed up to a bearing. To protect the jacks, plank bulkheads were erected and cuts 3 and 3 were blasted, then cuts 4 and 4, and so on. These cuts were about 1 ft. wide, and as their removal made room, sets of three jacks were inserted. In this

manner the full circle of concrete was cut away and replaced with 300 jacks, as indicated particularly by the exterior view. Experiment determined the safe spacing for holes and the size of the charges. For each cut three 1¼-in. holes were drilled one above another. Each hole was charged with a half stick of 60% dynamite, and the three charges were fired by delay exploders. One jackhamer and one tripod steam drill did the drilling. A steam boiler and a locomotive air compressor furnished the power to operate the drills. After any portion of the ring had been cut through, protection of the men and the jacks from the wash of the waves was necessary. This was accomplished by plank shutters arranged as shown by the exterior view. When the shaft had been mounted on the jacks, preparations were made for the tilting operation. The interior bracing to prevent lateral shifting of the ring has been mentioned. A possible weak point in the ring was at the doorway. To guard against failure there the bottom of the opening was first spanned by a plank against which the jacks bore. Just above these planks, three anchors were set in the bottom course of blocks on each side of the door; these anchors were then connected across the opening by rods with turnbuckles. Finally, side posts were set on the anchors, and on these an arch center was erected and wedged tight. With this preparation, no weakness developed in the ring on account of the door.



MOVABLE SHUTTERS PROTECTED JACKS FROM WASH OF WAVES

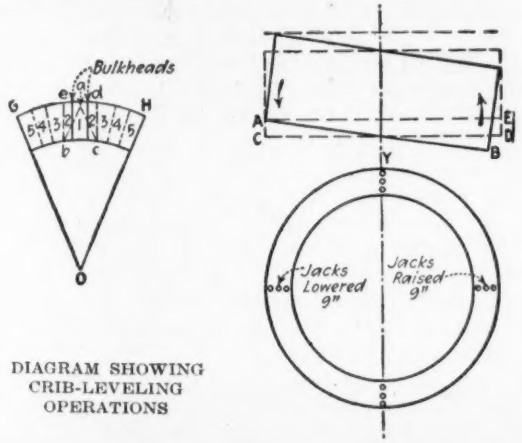
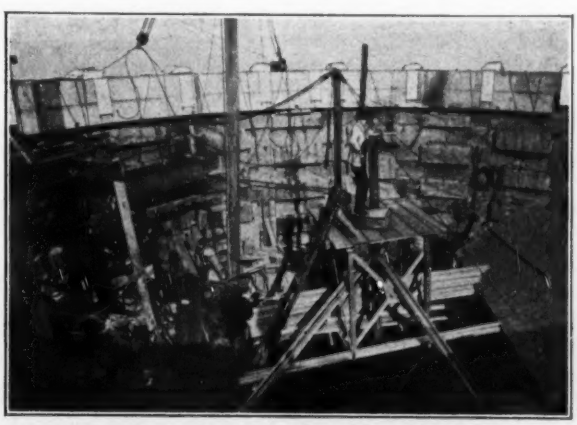


DIAGRAM SHOWING CRIB-LEVELING OPERATIONS

Preparation for instrument control of the jacking operations was made by erecting a pipe tower on the inner structure to carry the level, and building an observer's platform on independent supports. Around the inner edge of the masonary ring were set 24 targets at 15° intervals. On each target a top and bottom line marked the total change in elevation required at that point. These spaces were each divided into 100 equal parts. By this arrangement the instrumentman, swinging his telescope around, could check at sight the exact progress at each target. Down below, where the jack foreman stood, was a similar set of targets, so that as the observer called the figures above they could be noted below, and the foreman could speed up or slow down on any group of jacks, as conditions required. By this means no part of the jacking operations could get out of step more than a fractional part of an inch.

Twelve men operated the 300 jacks. These men were expert movers furnished by L. P. Friestedt Co. Referring to the sketch plan, it is seen that the jacks on the line of the neutral axis YY remained stationary, while those to the right were raised and those to the left were lowered in tilting the ring. The travel of the jacks varied from zero at the neutral axis to 9 in. at the points 90° from this axis.

When the ring had been jacked to level, brick underpinning masonry was substituted for the jacks, and the restoration was complete. The entire job took 30 days, and was carried out by city day labor under the direc-



INSTRUMENTMAN ON CENTER TOWER CONTROLLED JACKING BY SIGHTING ON RING OF TARGETS

tion of John Ericson, city engineer, and H. W. Claussen, assistant city engineer. Ernest Stromback was the engineer in local charge of the work.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

In Defence of the New Canadian Formula for Steel Columns

Sir—As a member of the committee responsible for the draft of a "General Specification for Steel Railway Bridges," published in the December *Journal* of the Engineering Institute of Canada, I desire to explain, in reply to Dr. Waddell's letter in *Engineering News-Record* of Jan. 16, p. 155, that the formula 12,000—0.3 $(l/r)^2$ was derived primarily from our interpretation of the published tests made by the Special Committee on Steel Columns and Struts, assuming 16,000 lb. per square inch (or one-half of the elastic limit) to be the proper unit-stress for tension members. If it should finally be decided to adopt a greater unit stress for tension members, the values in the column formula would be correspondingly increased; for it is, naturally, our aim to produce a specification which will result in structures of uniform strength, so far as practicable.

We obtained what we considered to be proper working values by taking the average of all the ultimate strengths of the solid columns for the several ratios of l/r, and dividing by 3, which figure is approximately the factor of safety on the ultimate strength of riveted tension members designed for a unit-stress of 16,000 lb. per square inch. These working values, as well as values derived from the formulas

$$12{,}000 \Big/ \left[1 + \frac{(l/r)^2}{36{,}000}\right] \text{ and } 12{,}000 - 0.3(l/r)^2$$

and 16,000 — 70 l/r, the latter used with a maximum of 14,000, are given in the table below:

l/r =	20	50	85	120	155
Working values	11,825	12,066	10,200	9,366	8,200
$12{,}000/\left(1+\left[\frac{(l/r)^2}{36000}\right]\right)$	11,900	11,230	10,000	9,580	7,200
$12{,}000-0.3\,(l/r)^2$	11,880	11,250	9,820	7,680	4,780
$16{,}000-70\,l/r$ (Max. 14,000)	14,000	12,500	10,850	7,600	5,150

In the above table, it will be noted that the Gordon formula,

$$12{,}000 \Big/ \left[1 + \frac{(l/r)^2}{36{,}000}\right]$$

agrees most closely with the working values derived from the Special Committee's tests, and may thus be considered as a safe guide in investigating the strength of existing structures; but the unit-stresses for ratios of l/r exceeding 85 are too high for practical reasons in new designs. Our parabolic formula 12,000 — 0.3 $(l/r)^2$ agrees very closely with the working values up to $l/r = 85$, and gives safe values when greater ratios are used, even to the limit of 200; moreover, its use is no more troublesome than use of straight-line formulas.

We are strongly opposed to limiting the ratio l/r to 100, as this restriction is not only a needless extravagance, but encourages the use of flimsily designed columns of fictitious strength.

There is nothing either radical or unusual in our column formula; the parabolic curve was proposed many years ago in this connection by the late J. B. Johnson, and many prominent bridge engineers in the United States are in favor of a much lower limit for compression in short columns than the allowed unit-stress for tension members. In this connection, the very valuable paper by J. R. Worcester on "Safe Stresses in Steel Columns," and the able discussion thereon, are recommended for careful study (See "Transactions" of the American Society of Civil Engineers, Vol. LXI, p. 150). The maximum unit-stresses for columns therein advocated by Mr. Worcester and others are, Worcester, 12,000; Prichard, 13,000; Seaman, 13,200; Emmons, 12,500; Horton, 10,666.

The American Railway Engineering Association's column formula is 16,000 — 70 l/r, with a maximum of 14,000 lb. per square inch. In the Quebec Bridge specification, compression members of carbon steel are limited to 14,000 lb. per square inch in conjunction with unit-stresses of 18,000 lb. per square inch for riveted tension members, and 20,000 lb. per square inch for eyebars, both of carbon steel.

R. S. Foulds, in an interesting article entitled "Column Tests and Formulas," published in *Engineering News-Record* of Aug. 9, 1917, p. 260, points out that the average strength of full-sized members in tension is about 54,000 lb. per square inch, net area; and in compression about 36,000 lb. per square inch gross area; that the elastic limits average about 30,000 in tension, and about 21,000 lb. (reduced) in compression. He claims that the J. B. Johnson parabolic formula 36,000 — 0.7 $(l/r)^2$ for ultimate strength is the most rational of all practical formulas, and that it corresponds to the average end conditions of bridge columns. Assuming the unit-stress of 16,000 for tension members, and taking into consideration the relative elastic limits of full-sized members in tension and compression (30,000 and 21,000, respectively), Mr. Foulds demonstrates that a working formula for columns of equal strength to that of the tension members should be: 11,000 — 0.214 $(l/r)^2$; or he would work to two-thirds of the elastic limit in both cases, using 20,000 lb. per square inch on the net section in tension, and 14,000 — 0.272 $(l/r)^2$ on the gross section in compression.

Finally, the Special Committee on Steel Columns and Struts, whose opinion cannot be ignored, recommends in its final report a working stress of 12,000 lb. per square inch for columns up to a slenderness ratio of 80; and 8000 lb. per square inch for columns having a slenderness ratio of 120, with interpolated values between these two ratios. Our proposed formula conforms practically to these recommendations for values of 0 and 120, but differs in using a curved line to connect these points, rather than a bent one.

Dr. Waddell refers to his formula 16,000 — 60 l/r, in comparison with ours, from which he concludes that compression members generally have either been overstressed by 15 to 25% or that the adoption of our formula would result in a corresponding waste of material. But the American Railway Engineering Association's formula, the one in most general use in recent years, is

16,000 — 70 l/r, with a maximum of 14,000; and the greatest difference between this formula and ours is 2250 lb. for $l/r = 28.5$, or about 16 per cent., whereas there is no difference when $l/r = 100$.

Referring to the so-called inconsistency between the formula 16,000 — 200 l/b for the compression flanges of beams, and our formula for columns, it is well understood that the two cases are by no means analogous; for the web of a beam provides continuous lateral support, and the empirical formula limiting the compressive unit-stress is provided to prevent the use of unreasonably narrow flanges.

Replying to the editorial comment in the same issue of *Engineering News-Record*, I would suggest that the compression members of a bridge are not of necessity properly proportioned, or of equal strength to the tension members, simply because they have shown no signs of weakness. No indications of weakness should be expected in a column as long as the stresses therein are within the elastic limit of the metal; and, with our liberal allowances for impact and for reversal of stress, few compression members, if proportioned by any of the recognized formulas, are likely to be subject to stresses of greater intensity than one-half of the elastic limit.

We all desire uniform strength throughout in our structures; and, taking into consideration the probability of increased loads in the future, together with deterioration from corrosion, a factor of safety of 2 on the elastic limit does not seem excessive for bridges.

W. CHASE THOMSON,
Consulting Engineer.
New Birks Bldg., Montreal, Can.

An Appreciation of Roosevelt

Sir—I have been very glad to note the appreciation of Col. Theodore Roosevelt in your Jan. 9 issue. As one who had the honor of meeting him in a more or less casual but still continuous way for 40 years, I have naturally come to know something of his interest in invention and engineering. This dated back to the time when, as a Harvard undergraduate, and through my humble intervention, he made his first acquaintance with the marvels of the Edison phonograph and the Bell telephone, to the accompaniment of music furnished by an organ built by his uncle, Hilbourne Roosevelt, one of the great organ builders of his time and a master of sound and mechanics.

During one of the intervening years, I had the honor of getting Governor Roosevelt to open by wire our electrical exhibition in New York City and discuss once again topics in the forefront of engineering. Some years ago, I was member of a committee on behalf of the engineering societies to ask President Roosevelt to open our splendid engineering building in New York City. He did this by message but not in person because, unfortunately, owing to complications in Washington, he could not leave; and, as he said jokingly in an aside, he "really was too busy to go chasing all over the country opening buildings for Carnegie;" but the protest was almost apologetic, and he was very much in sympathy with us. He had just declined to open a Carnegie building in Pittsburgh.

At another time I had the privilege of being, as the editor of the *Electrical World*, one of the four technical journalists invited to sit in at the first conservation congress in Washington, to which you refer so admirably. The conservation movement, as I sized it up, had begun with Richard Watson Gilder and Robert Underwood Johnson, editors of the *Century Magazine*, but President Roosevelt was wholly caught up in the spirit and enthusiasm of the movement; and from that time to this a new realization has existed in America of the value of our natural resources and of what the engineer is doing. Our whole civilization is an engineering exhibit, but conservation remains abortive; and it is amazing that after these many years, since the historical conservation conference at the White House, Congress is still allowing the water-powers of the country, then emphasized so strongly, to linger in wasteful neglect.

As one who frequently differed from his policies and practices, but who found him ever sympathetic to all the larger ideas of life and an intense admirer of the genius of our great inventors and engineers, I trust I am not exceeding the bounds of propriety in adding this little tribute to the memory of one of our noblest Americans.

THOMAS COMMERFORD MARTIN,
Secretary, National Electric Light Association.
New York City.

The Durham Land Colony

Sir—The article in *Engineering News-Record* of Dec. 5, 1918, describing the land colony at Durham, Cal., treats of an interesting and valuable experiment in land colonization. There are, however, a few points to which additional attention should be directed.

First, the real estate "shark" and his commissions were *not* eliminated. This fact was not known to the general public at the time when the land was originally sold nor, probably, was it known to the Land Settlement Board. Since that time, however, the two men who engineered the deal got into a dispute over the division of profits. In the suit that followed it was disclosed that their admitted profits on their options were considerably larger than the usual real estate agent's commission on sales of that size.

Second, the article makes a comparison between the overhead expense of $5918, for the first year of the project, and an assumed cost of selling alone, under private development, of $75,000. No analysis of the latter estimate is possible, but it might be stated that the amount is much greater than the selling costs per acre on several private projects of a similar character. With regard to the former sum, a simple mental operation shows that it amounts to a little less than $500 per month. A study of the statement of the amount of work performed during that time would indicate that some over-enthusiastic adherents of the plan of colonization have fallen, perhaps unwittingly, into the old error of public-ownership bookkeeping, and have made no proper distribution of the salaries and other expenses of state officials who devoted part of their time to the project. There is much to be said in favor of the proposition that the taxpayers of the state as a whole should help support the project, since its success will benefit the state as a whole, but the taxpayers should be apprised that they are doing so.

These notes have been written not with the intention of belittling the importance of the Durham experiment,

which I consider a step in the right direction, but rather because too fulsome praise of many a good plan has, in the end, militated against its success. Basing my opinion on my own experience as engineer for several colonization projects in California, I would say that the lessons so far to be learned from the Durham experiment are as follows: (1) Colonists should be carefully selected, not taking any man who happens to have the money for the first payment on the land, but rather selecting them partly for financial resources and mainly for experience in farming, for industry, and for general ability, to the end that every colonist should have a reasonable chance of success; (2) they should not be turned out on raw land to sink or swim—usually the former—but should have done for them at least part of the work of establishing an improved farm; (3) they should have the advice of experts, particularly during the first few years after settling on the land. Private colonization companies throughout the West are becoming cognizant of these facts, and many of them are acting upon this knowledge. It takes large capital, however, to do these things, which is one point where the state has an undoubted advantage over the private concerns, in the lower interest rates and better credit generally.

Disregarding the bookkeeping "camouflage" already mentioned, there is no doubt that, with the large amount of free advertising and the free administrative services of the able men on the Land Settlement Board as well, this first state colony is being handled more cheaply than would be possible on a private project. It remains to be seen, however, whether the total cost per acre of taking the raw land in large holdings and delivering improved farms to the colonist will in general be any less on a state-administered than on a private project.

A. T. PARSONS.

420 Market St., San Francisco, Cal.

[Mr. Parsons' letter was submitted to Dr. Mead, whose reply follows.—EDITOR.]

Sir—The letter of A. T. Parsons, commenting on the article on the state land settlement at Durham, printed in *Engineering News-Record* of Dec. 5, 1918, p. 1014, concedes that it puts into actual practice what he regards as the three essentials of successful settlement. The further statement might have been made that by doing this Durham has done more to improve the methods and practices of private colonization enterprises than all the legislation of the past ten years. Example is proving a better educator than precept.

The criticism that the article makes a better financial showing for Government action than the facts justify, and that the taxpayer is footing a larger part of the bill than it stated, is evidently due to a lack of knowledge of one of the most important features of this legislation. This needs to be cleared up. Mr. Parsons suggests that the real explanation is errors in public-ownership bookkeeping, and that the taxpayers of the state are paying the difference between the sum stated in the article and the actual cost. This is not the case. The amount of administrative expenses to be charged against this undertaking *was not fixed by the Land Settlement Board, but by the accountants of the State Board of Control.* If the cost had been larger that board would have said so, and, if they had fixed it at ten times the sum, this extra cost would not have fallen on the taxpayers of the state but would have been paid by the settlers *because the law requires all expenses of every kind to be so paid.* It is a self-supporting enterprise in the full sense.

The Department of Public Accounting in its report of this board's operations gives the following services as having been rendered without cost to the Land Settlement Board:

The University of California, salary of Dr. Elwood Mead and the use of an office in Agriculture Hall, Berkeley; Division of Soil Technology, University of California, soil surveys; United States Bureau of Roads and Rural Engineering, preparation of plans for irrigation and drainage works; State Department of Engineering, preparation of settlers' house plans; Attorney General, legal services; Board of Control, installation of accounting procedure. (To these might be added the services of the members of the board who have no salaries.)

It will be observed that the first three of these free services are rendered by agencies paid by the state and Federal Governments to promote the success of agriculture and to advance rural civilization. If the educational value of the work done at Durham was equal to work which might have been done elsewhere, and which would have been done elsewhere at public expense, then the Board of Control was correct in not charging this particular enterprise with any part of the salaries. All of the traveling and living expenses of officials that worked there were charged against the settlement.

The chairman of the board performed his duties in addition to his university work. The time given to constructive planning there has taught the state what successful settlement requires, more effectively than by talking about principles in a classroom. The Division of Soil Technology is making a soil survey of California as a foundation for the scientific agriculture of the future. It is a work that ought to be done, but some of the soil maps already made are now gathering dust. The soil map made for Durham was put to immediate and practical use. The settlers know why the acreage price of land was varied. Some of them speak with a sort of awe of the fact that they can trace in their crops the lines of the soil map. In other words, the science of soils has got a grip on the people of that settlement that it ought to have on the whole country, but which it is too often slow of securing. The settlers were not charged with the cost of that soil map, because the maps are everywhere made at public expense.

The Bureau of Rural Engineering has for years been giving to anyone who asked free advice about irrigation and drainage, which sometimes was labor thrown away because the advice was not followed. Here they had the inspiring opportunity of preparing a plan that they know would be carried out.

The professor of sanitary engineering was able here to create a mosquito-abatement district and thus forestall any possible malarial troubles. Usually he is not called in until illness has made remedial measures unavoidable.

The help rendered by the State Department of Engineering was given during a season of the year when

it could be done by people paid annual salaries, without any interference with other duties. It is of course admitted that there might be times when such free services could not be rendered, but if that had been the case it would have been charged and the settlers would have paid it, not the taxpayer. The services rendered by other departments were valuable, but not costly, and are rendered to all other public agencies, so that the decision of the State Accounting Board that they should not be charged here was in accordance with the general practice of the state.

The important point is not that the Durham colony was established at a small expense, but that the most efficient use of agricultural leaders was made there. This is a fact of great significance. The United States now spends more than any other two nations of the world for education in agriculture and to promote rural progress. Valuable as are the services now rendered, no one can study rural conditions without believing that, if experts were more widely used to create right conditions, as they were used at Durham, far more valuable results would be obtained. At present their work is largely corrective and not creative. They help to reform evils after becoming serious, but they allow others to arise without hindrance. At Durham the opportunity to build a rural neighborhood as it ought to be built, and in doing this to show how clearly they understood the problems of rural life, was given to the experts. Such use of them is the best use, and is destined to grow. California has not only formulated a plan which gives to poor men broader opportunities to obtain a home than they had before, but it has introduced an idea into education that is destined to have large application in the future.

No legislation can eliminate the real estate "shark," but, as the article truly said, the "shark" was eliminated in this case in selling the land to settlers. They knew what they were getting and they paid no commissions.

With regard to the saving to settlers which resulted from absence of commissions on sales, the article was conservative. The investigations of the Rural Credits and Land Settlement Commission of California, made in 1915 and 1916, showed that commissions of colonization agencies range from 10 to 30%. The State Land Settlement Board sold to settlers $744,928 worth of land. At the lowest commission this would be nearly $75,000. The average would have been more than this.

ELWOOD MEAD,
Chairman, Land Settlement Board.

Berkeley, Cal.

The New York Central Train Wreck

Sir—I presume readers of *Engineering News-Record* will be interested in the wreck on the New York Central near Batavia, N. Y., on Sunday morning, Jan. 12, as observed by a passenger on Train No. 11 which crashed into No. 17. I was engaged in the rescue work for two or three hours following the crash.

The rear coach of Train No. 17, which was telescoped, is described in the Associated Press dispatches as made of steel. This may be true, but I have serious doubts. If it was a steel car it was of old design, for the exterior resembled that of a wooden car of old-fashioned type. The wreckage at the end of this car smouldered considerably but did not burn with much vigor, indicating that there must have been wood in it; furthermore, the fireman who came down from Batavia on the engine which was to assist Train No. 17 told me that the car had a wooden frame. If the roof of the telescoped car in some way had become dislodged it is conceivable that it might have been telescoped by the car ahead, but this is more or less improbable. I was on both sides of the wreck and up and down the track on both sides, and did not notice the roof of the telescoped car lying about.

It seems to me that if the rear coach of Train No. 17 had been of modern steel construction, such as the coach which telescoped it, there would have been almost no loss of life, if any at all. Unquestionably, we would all probably have been shaken up more than we were, but the loss of life was due entirely to the telescoping. Practically the entire force of the shock of the collision was taken up in the telescoped car, for not a single truck left the tracks.

If my supposition as to the use of wood in the construction of the demolished coach is correct, I believe that something should be done to make it a high crime to permit the use of even steel-lined cars on these fast trains.

HARLAND BARTHOLOMEW,
Engineer, City Plan Commission.

St. Louis, Mo.

More Comment on Engineers' Salaries

Sir—I note with interest the following advertisement in your issue of Dec. 19:

"Wanted—Transitman on stadia topography and location of property lines in Southern mountains, to live in isolated district in camp. Long job for desirable man. Salary $90 per month with maintainance in camp. In answer state age, school experience, if married and date available. Only preferred applications will be answered. ————" I omit the name of the firm, for obvious reasons.

It is possible some young engineer more anxious for a job than for what it is worth may take it at that price, but to advertise for men competent to do the work outlined and offer only $90 per month is an insult to the engineering profession. Here in Minnesota common, unskilled labor is getting more than that.

I have on my table at this minute a daily paper commenting on the fact that boys of school age had skipped school and earned $50 per week. This last item was from Philadelphia. My vocabulary is inadequate for further comment.

D. C. WASHBURN.

Elk River, Minn.

Corrects Statement of Levelman's Pay

Sir—In your issue of Jan. 9, p. 106, appears a letter signed "E. N. Gineer," which reads in part: "This is in striking contrast to $35 a month received by a leveler on a line now owned by the Baltimore and Ohio R.R., with $15 added for board."

I wish to say that this is undoubtedly a misprint, as our standard salary for a levelman is $145 per month and expenses over and above $25 when away from headquarters.

R. REIMANN,
Assistant Engineer, Baltimore & Ohio Railroad.

Baltimore, Md.

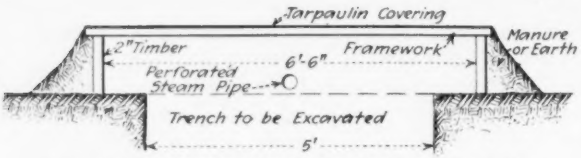
HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Steam Thawing Box Reduces Winter Cost of Trench Excavation

BY L. MCLAREN HUNTER
Engineer Main Drainage, Ottawa, Ont.

FOR thawing frozen ground over the line of trench where a large sewer was to be constructed, the method shown by the sketch was successfully used. Steam was supplied by the derrick boiler. The thawing



STEAM BOX FOR THAWING FROZEN GROUND

apparatus was placed in position in the morning for the next day's work, and the steam was kept on continuously for the 24 hours. When the box was lifted forward we were able to excavate with ease without the use of picks. This method brought the cost of the work down almost to the level of what it was in summer.

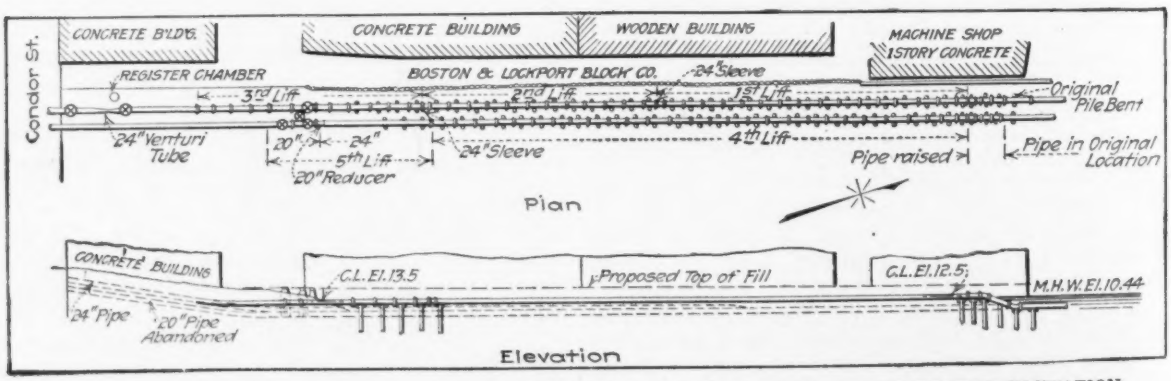
Raising Two Lines of 24-Inch Water Main Seven Feet

BY FRED J. SAUER, JR.

SCREW rods operating through timber cross-blocks supported on piles were recently used to lift to a new position two lines of 24-in. cast-iron water main at Boston. The work was done by the Boston & Lockport Block Co. in connection with an extension of its plant. Land was purchased from the City of Boston, subject to an easement for two 24-in. Class D water mains belonging partly to the City of Boston and partly to the Metropolitan Water District and connecting a tunnel under Chelsea Creek with the system supplying East Boston.

The pipes are 9 ft. c. to c. and enter the yard at an angle of about 10° with the horizontal and at an elevation considerably above high water. They originally continued at this angle for a distance of about 120 ft. From this point northerly the pipes were nearly horizontal at an elevation of from 4 to 6 ft. below mean high tide, the change in direction being made up in the joints. Approximately 700 ft. of pipe was partly exposed, being supported on piles at about the level of the flats. The remaining 250 ft. had been filled to a maximum cover of 14 ft. The grade of the Boston & Lockport Block Co.'s yard is about 11 ft. above the top of the pipes, so that in order to fill the newly acquired land to the existing grade without making the pipes inaccessible it was necessary to raise the pipes 7 feet.

The piles and caps supporting the present pipe were in poor condition, having been exposed between the tides for nearly 50 years, and the soft mud in which the pipes were located made impracticable any system of raising from underneath. For the pipe that was exposed, or only covered to a depth of 3 to 4 ft., the method adopted consisted of driving 10-in. spruce piles on both sides of the pipe about 5 ft. c. to c. across the pipe and about 2 ft. behind each bell. The tops of the piles were left at least 10 ft. above the top of the pipe. The caps consisted of two 6 x 12-in. timbers, leaving a 6-in. tenon. These caps were used both to raise the pipe and as its final support and were designed to carry the weight of the earth fill and a heavy street load. For raising, the caps supported a 14 x 14-in. cast-iron bearing plate, through the center of which passed a screw which was raised by turning a threaded nut in a similar manner to the operation of a hand capstan. The screws were 2½ in. in diameter and lifted ½ in. for each complete revolution of the nut, the maximum lift without blocking being about 6½ ft. Wire-rope slings were used around the pipe. After the pipe



PLAN AND ELEVATION OF TWO LINES OF CAST-IRON WATER MAIN LIFTED TO HIGHER ELEVATION

The dotted lines on the elevation show the original level, and the full lines the level of the pipe as raised.

was raised to grade the caps were set under the pipe, and the piles were cut off at the top of the caps in their new position. The piles varied from 20 to 40 ft. in length, leaving from 10 to 30 ft. below the surface of the mud. No spur piles or bracing were used. The driving was done while the pipes were carrying water under 60 lb. pressure, the driving being done partly from a lighter and partly from a land machine. The lighter drew 30 in. of water and, as the pipes were only covered by from 4 to 6 ft. of water at mean high tide it was not possible to stay over the pipes for more than three hours each tide. The raising in fill was complicated by the local formation, a loose fill having been placed over the mud to a maximum depth of 14 ft., forming a very treacherous bank. The westerly pipe, which was 24 in. for its entire length, was not cut at the southerly end. The pipe was uncovered for a distance of about 24 ft. south of the point where it reached the proposed new grade, and as the pipe was raised the joints adjusted themselves to the new alignment, each joint being pulled out ½ in. at the bottom. This straightening forced the whole section ahead 6 in., although the actual shortening of the line was only about 2 in. The raising was done in a manner similar to that described, except that no piles were driven, the bearing plates resting on long timbers that stretched across the trench to a firm bearing on either side.

ONE LINE OF PIPE HAS BEEN RAISED AND ONE IS IN ITS ORIGINAL POSITION

The easterly pipe, which at the southerly end reduces to a 20-in. line, was cut beyond the second gate. It was not considered economical to salvage the pipe beyond this point, as the city authorities were not willing to leave any of the pipe with the original cover. It was agreed that from this point to the street the easterly line should be replaced by a new pipe to be furnished and placed by the City of Boston.

At the southerly end were four gates. One of these was on a cross-over between the two mains, by means of which the flow of both lines was normally passed through a venturi meter. As it was necessary to maintain the flow through one line while the work was in progress, this gate had to be removed and reconnected after the lines had been raised.

The pipe was raised in five sections, the longest being 330 ft. It was found possible, with one man at each screw and one screw to each length of pipe, to raise at a rate of 1 ft. per hour, after the mud suction had been eliminated. With one screw for two lengths of pipe, it was necessary to provide three men at each screw, and the pipe was not so easily kept in good alignment.

The outer connections were made up of two ⅛ bends and 15 ft. of straight pipe. On account of the difficulty of working in the soft mud, they were placed from a lighter, a connection being made up on the deck and hoisted into place as a unit.

The work was done in a period of 10 weeks, most of the delay being on account of the difficulty of obtaining labor. In using the figures on cost it must be borne in mind that labor conditions were acute owing to war demands as well as the influenza epidemic.

The cost of the work, excluding engineering, was about $8000, or $8.50 per linear ft., distributed approximately as shown in the following table:

	Quantity (Approximate)	Cost per Foot of Pipe Raised	Cost per Unit	Total Cost
Excavation	500 cu.yd. (200 cu.yd. wet)	$1.06	$2.00 cu.yd.	$1,000
Piles furnished and driven.	142 piles, 4,700 lin.ft.	2.48	$0.50 lin.ft.	2,350
Lumber and hardware		.84	Y. P. 6x12 in. $80 per M. Hardware 7c. per lb.	800
Pipe connections		.74	Pipe specials 7c. per lb. lead 10c.	700
Gate chambers	4	.37	$87.50 ea.	350
Carpentry	144 sets of caps	1.06	6.95 per set	1,000
Backfill	500 cu.yd.	.32	.60 cu.yd.	300
All other work, including raising, setting, slings, and screws, etc., for 950 lin.ft. pipe		1.58		1,500

William Jackson, formerly city engineer of Boston and engineer for the Boston Water Board, in his report for 1886 describes the raising of 1870 lin.ft. of 48-in. main, the maximum distance raised being 18 ft. No costs are given. In *Engineering Record* of June 20, 1903, John L. Howard, division engineer of the Metropolitan Water-Works, describes a similar job of raising 36-in. mains, in which the cost is given as $11.03 per foot.

The piledriving and capping were done by the Aberthaw Construction Co. The jointing and connecting were done by the maintenance division of the Metropolitan Water Department, under the direction of S. E. Killam. The work was subject to the approval of the Metropolitan Water Board and the City of Boston, and was under the immediate supervision of the writer, who was advised by C. W. Sherman, of Metcalf & Eddy, consulting engineers, Boston.

NEWS OF THE WEEK

New York, January 30, 1919

Bills For Employment on Public Works

Two Measures Introduced in Congress to Promote Municipal and Governmental Projects

Two bills looking to the appropriation of money for public works construction of all kinds are now before Congress. One of them, introduced by Senator Kenyon of Iowa, was briefly described in last week's issue of *Engineering News-Record*. The other was introduced by Representative Kelly of Pennsylvania and provides for the creation of a United States Construction Service.

Under the Kenyon bill there would be established a United States Emergency Public Works Board, consisting of the Chief of Engineers of the United States Army, an officer of the Department of the Interior, an officer of the Treasury, and two citizens to be appointed by the President. The board would have direct supervision over all public works of the Federal Government in the present emergency, and for those works $100,000,000 would be provided. All agencies of the Federal Government would have to report to the board, within 30 days after the passage of the act, the construction plans they are contemplating.

In addition, the act would authorize the War Finance Corporation, for a period of one year, to make loans to the various states in order that emergency public works might be undertaken. Loans might be made by the War Finance Corporation for the work of counties and municipalities, but the Federal Government's relations would be with the state and the state would have to arrange for the advancement of the money to its local subdivisions.

In every case, whether for Federal Government or other public works, expenditures may be made only after there has been filed with the board a certificate of the Secretary of Labor stating that extraordinary unemployment exists in the particular community or vicinity in which the proposed works are located. The inspection of the work done with funds advanced by the War Finance Corporation would be made by officers of the Corps of Engineers.

Representative Kelly's bill would authorize the appointment of a National Emergency Board for Soldier Employment, consisting of the Secretaries of Labor, Agriculture and the Interior. This board would undertake the organization of a body of workers to be

(*Concluded on p.* 258)

Will Devastated France Be Rebuilt?

Credit Conditions and Other Economic Factors Will Greatly Retard Work and Be a Barrier to Aid From America

Readers of this article will find a detailed summary of the destruction in France, and of the reconstruction plans, on page 218 *of this issue.*—EDITOR.

"Why should be rebuild the ruins?" is the question in the minds of industrial and financial leaders in France. A complete change in the manufacturing layout of the country, due to the shifting and the taking root elsewhere of the industries formerly in the devastated areas, the necessity for preserving, with the limited means available, the existing industries that have expanded under war-time demands, and the financial conditions that will make the forming of commercial credits a slow process after the Governmental credits disappear with the signing of peace—all tend to delay greatly the reconstruction process and make the offering of help from the United States, either industrial or engineering, a difficult problem. This is the burden of a message brought from France to the manufacturers, engineers and contractors of this country by Pierce C. Williams, commercial attaché of the American embassy in Paris. On the other hand, he says, the large iron and steel plants in the areas occupied by the Germans where only a minimum amount of fighting was done can be put on a working basis in a comparatively short time, and the German plants in the recovered territories of Alsace and Lorraine are immediately available, so that France herself will be able to produce an amount of steel products almost, if not quite, equal to the necessities of her industries.

The rebuilding of the totally destroyed sections, if considered at all, will be subject to a number of important factors. The destruction included a large portion of the French coal industry that will, of course, have to be revived, but it also comprises several hundred miles of totally deserted farmlands so badly torn up by shell fire that it probably will never again be cultivated, but will probably be given over to pine forests. This area was dotted with towns and villages, as well as with many populous cities, some of which were considered among the most important industrial centers of France. Their industries included mines, blast furnaces, steel, textile and chemical plants and electric-power stations. But with the precedent in mind, that areas devastated in former wars were never rebuilt, and considering the fact that the inhabitants of these cities, towns and farms, are either dead or widely scattered, it is thought probable that these regions may also remain as they are.

RESTORATION SLOW AND DIFFICULT

The sugar industry was also located in this section, the sugar beet having been raised nowhere else in France, but the mills are totally destroyed, having been, among others, a special target of German destructiveness. The beets were raised on small farms, and the buyers from the mills went among the peasants and bought up their raw material in small lots. Should these people return, the mill owner will ask, "Why build a mill when there are no beets?" and the peasant will ask, "Why raise beets if there is no mill to take them?" And, as pointed out by Mr. Williams, the synchronizing of these two branches of this industry will be a slow and difficult process.

The rebuilding of the iron and steel plants in the totally destroyed area presents another phase of the matter, with further difficulties. In the first place, the coal mines, flooded and otherwise damaged, must be restored and, second, the mills will have to be built according to local ideas and customs, since that part of the world has its own

Employment

For the convenience of engineers returning from military life, and others, there are listed below agencies which may be helpful to those who are seeking employment:

Engineering Societies Employment Bureau; Walter V. Brown, secretary, 29 West 39th St., New York City.

Division of Engineering, United States Employment Service, 29 South La Salle St., Chicago, Ill.

Professional and Special Section, United States Employment Service; George W. Kirchwey, state director, 16 East 42nd St., New York City.

ideas to which it will be necessary to conform.

Until the final retreat of the Germans certain of the coal mines lying well within the battle lines were kept in more or less continuous operation, but just before the departure of the enemy he destroyed the hoisting apparatus and power plants and blasted out the concrete lining of the shafts as far down as possible. The top soil in this part of France consists of sandy silt very similar to the "muck" familiar to many of the tunnel builders and miners of our own country. This was held in place by concrete shaft-lining. The destruction of this not only flooded the mines with surface water, but precipitated down the shaft an avalanche of water-soaked sand and silt, together with the wreckage of the head works, thus making it impossible even to estimate the amount of damage that has been done. One representative mine in the Vimy Ridge battle ground, the location of which is now indicated only by a heap of bricks, twisted pipe and bits of machinery, was worked in five levels and had a shaft 1500 ft. deep. The owners told Mr. Williams that the water now stood within 50 ft. of the surface, and that they were unable even to predict when coal could be mined in paying quantity. Before that is possible, or even before coal-extracting machinery can be purchased, the owners point out, the coal mines must be entirely cleared of water. This, they say, will take from one to two years. The French officials and engineers responsible for organizing the work of "reconstituting" the coal mines are now assembling pumps, hoists, gas engines, and electric motors, etc., in order to begin the work as soon as possible. But not until this is well under way will there be any means of predicting when coal can once more be produced in large enough quantities to make feasible the rebuilding of the iron and steel plants, or even the mining villages and surface works. Since, as pointed out by Mr. Williams, the industrial plants depend on this supply of coal, there being no hydraulic or electric power available as a substitute in that part of France, delay is inevitable.

Outside Aid May Not Be Needed

On the other hand, outside assistance may not be needed to any great extent, because the French did not develop their iron and steel industries as completely as possible, preferring to export large amounts of the raw ore to Belgium and Germany, and they will probably export again. Furthermore, the iron and steel works in eastern France suffered only from pillaging. The steel and iron men told Mr. Williams that the warning sent out by President Wilson against wholesale destruction in their retreat was undoubtedly heeded by the Germans, and such operations were definitely checked. Of all of the iron mines only three were damaged to any

(Concluded on page 258)

Urge Passage of Bill for Hudson River Vehicular Tunnel

The Merchants' Association of New York City has asked Governor Smith to support the project for a vehicular tunnel under the Hudson River, between New York City and New Jersey, which provides that the estimated cost of $6,000,000 shall be paid equally by the States of New York and New Jersey. Bills for this purpose are now before the two state legislatures, since Congress has virtually refused Federal financial support. The association's letter to the Governor urges that an appropriation of $1,000,000 be made for immediate use.

"Careful consideration was given by our committee to the possibility that such a tunnel might have the effect of diverting to New Jersey industries which would otherwise locate or continue their location in New York. We do not believe that this would be the result, but, on the contrary, think that the benefits would be mutually reciprocal," the letter says. It states that there is a strong tendency at present to divert business from the port of New York to points where the port charges are less and that it becomes important that economies should be effected wherever possible in port charges.

Large Road Appropriation Combined With Post Office Bill

An appropriation for $200,000, for roads has been added to the House Post Office appropriation bill by the United States Senate Committee on Post Offices and Post Roads. The original bill as it came from the House provided for an expenditure of $357,782,000. The amended bill provides for $50,000,000 this year and $75,000,000 each in 1920 and 1921.

State-Insured Highway Construction Contracts Suggested

Consideration of a system whereby a state may provide its own insurance for the completion of highway contracts is suggested by Edwin Duffey, state highway commissioner, in his annual report to the New York legislature. The plan, if adopted, would eliminate the present practice of requiring contractors to furnish bond through one of the many surety companies. It has been the custom of these companies to furnish certified checks guaranteeing the execution of the contract, and bonds for the performance of the work, and this has been done for inefficient contractors, with little if any capital. This has resulted in poor performance. The undesirableness of this procedure has been emphasized by the abnormal conditions due to the war and by the refusal of the surety companies to take over and complete the contracts promptly.

In reviewing the inconvenience and loss thus produced, the report states that large amounts have been paid to the bonding companies by contractors, and, through their contracts, by the state, since the highway system was begun. In this time the companies have lost little money, but now that an emergency has arisen, the responsibilities which were assumed when the premiums were paid are disclaimed on the grounds of abnormal conditions.

The state carries its own fire insurance on state buildings and its own compensation insurance. In concluding, the report says:

"It would seem that a plan could be evolved by which the state could insure its own contracts and thus receive the protection for which payment is made; and the attention of the legislature is directed to this subject for such consideration as it deems advisable."

American Society Will Discuss Railroad Situation

Francis Lee Stuart, lately chairman of the Budget Committee of Eastern Railroads, will address the New York meeting of the American Society of Civil Engineers Feb. 5 on the national railroad situation today and a suggested basis for legislation.

Proposed New Water Law for State of Idaho

A proposed new water law for the State of Idaho was the principal engineering subject discussed at the joint conference of the Idaho Society of Engineers, the Idaho Irrigation Congress, and other associations interested in the agricultural development of the state. The conference was held at Twin Falls, Idaho, Jan. 13-17. The draft of the text, written by a committee of the Irrigation Congress appointed for that purpose, is based on the laws of Oregon and Washington, and also on the present Idaho law. A bureau of water rights is proposed, consisting of three men appointed by the Governor for terms of nine years each, one member to be appointed each third year. The members would be paid not less than $4000 and not more than $7500 a year. The bureau would take over the duties of the present state engineer as regards the distribution of water and the approval of plans for irrigation-district work; also the duties of the State Land Board in connection with its Carey act irrigation project; it would also make adjudications of water rights, subject to confirmation by the court. It is felt that the last-named change would save much of the expense and delay incident to the court's procedure as now carried out.

The act provides for changes in the methods of selecting and paying water masters on the various streams of the state, which changes, it is thought, would materially increase the efficiency of these men. In the selection of members of the proposed new board, the intent of the act drafted is to secure men of experience in the control of water resources, and to see that at least one member of the bureau is an engineer of ten years' experience.

Bills Provide Employment on Public Works

(*Concluded from page* 256)

known as the United States Construction Service, which would act under the general supervision of the Director of Soldier Employment. Employment in such service would be entirely voluntary. The works that the United States Construction Service would undertake would be the reclamation and preparation of agricultural lands, the establishment of logging operations and sawmills, the development of coal lands, and the building of roads, waterways and general public improvements that would aid or advance the projects of land settlement, forestry or mineral development which would be undertaken. All agricultural lands would be leased to settlers, not sold. The act would carry an appropriation of $500,000,000, said money to be raised for the Treasury by means of an issue of certificates of indebtedness bearing 3% interest.

Workers joining the United States Construction Service might be those who have been in civilian occupations, as well as discharged soldiers and sailors.

Provision is made for coöperative contracts with the various states for land settlement, forestry and mineral developments, the Government's contribution in such cases not to exceed 75% of the total cost of the projects.

Interstate Commission Overrules Director General's Rates

The Interstate Commerce Commission Jan. 20 in a decision written by Clyde B. Aitchison, formerly a member of the Oregon State Railroad Commission, overruled the rate on lumber products in the Pacific Lumber Co. case against the Northwestern Pacific Railroad Co. and others. It decided that the present rates charged for the transportation of lumber and other forest products from Humboldt Bay points to destinations in defined territories east of Denver, Colo., are unreasonable in that they exceed the rates contemporaneously in effect for California coast group points to the same destinations. The defendant railroads named in the case include virtually all the great lines in the Federaly-controlled systems from coast to coast, and the order issued by the commission notifies them to cease before May 15, 1919, from publishing, demanding or collecting present lumber rates, as covered by the decision, and to file new rates in accordance with the terms of that decision.

The new Director General of Railroads, Walker D. Hines, on Jan. 21 issued a formal statement in which he acknowledged the right of the Interstate Commerce Commission to review any of the rates initiated by the Director General, and denies that the latter has thought of contesting the right of the commission to make such a review of rates. He said the Federal control act places the power of review specifically in the hands of the Interstate Commerce Commission, and that at no time since the Government took possession of the railroads has there been conflict in jurisdiction between the commission and the Director General.

Form National Highway Association

Delegates from 37 highway associations, each having a trail of over 500 miles, touching at least three states, met at Kansas City, Mo., last week, and formed a permanent organization to be known as "The Associated Highways of America." Representatives from every state in the Union, except Massachusetts, were present, and 48 different organizations applied for membership. Of these, 37 were found eligible.

Nashville Engineering Association Publishes Strong Appeal

In a full-page advertisement in the Sunday *Nashville Tennessean* the Engineering Association of Nashville, Tenn., on Jan. 18 made the following strong appeal, addressed as an open letter to the members of the sixty-first General Assembly of Tennessee:

"The Federal Government realizes that this period, immediately following the close of the war, is beset with grave dangers from the social and conomic unrest, resulting from the increasing surplus of labor. The Department of Labor has created a new division, with the object of stabilizing these conditions and hastening the return of normal peace-time prosperity.

"This division has made careful investigations, and has arrived at the conclusion that the one industry which will most quickly start the wheels of progress is the building industry. Secretary Baker, realizing that private enterprises could not be expected to advance when the Government enterprises are stopped, says:

"'We strongly urge that all public improvements be advanced to absorb labor; we ask that you use all influence with the state, county and municipal authorities to this end. Preliminary steps should be taken, in order that necessary authority may be secured in time for operation upon the opening of the construction season.'

"The Engineering Association of Nashville has already started such a campaign, and has the vigorous indorsement of the Department of Labor, and it asks you, Mr. Legislator, to take immediate steps to have all contemplated state work, such as buildings, bridges and roads, ready to start when the season opens.

"Granting that the cost may be more than at a later period—though there is little justification for such a belief—is it not better to spend this extra cost and get needed improvements than for our entire citizenship to suffer immeasurably more on account of idleness?"

Devastated France

(*Continued from p.* 256)

extent, and they not irreparably. It is evident, then, that no great amount of assistance will be needed in this industry. These mines, as well as those in German Alsace-Lorraine, will be worked to capacity to take care of the demobilized soldiers and assure a supply of raw material as soon as possible.

The coal necessary for their immediate operation, as well as the operation of other industries throughout France, that cannot be supplied by their own mines, will be drawn from other countries.

As to supplying needed material throughout the rest of France, Mr. Williams states that it is necessary that everything that can possibly be manufactured in France should be turned over to the French factories. While there has been enormous destruction of industrial capacity in the north of France, there has been in many lines a counterbalancing expansion in the center and southwest of France, particularly among factories that could produce any sort of munitions of war. These factories will be unable to guarantee jobs to demobilized French soldiers unless they are assured of orders growing out of the restoration of the devastated region. It is the task of the new Ministry of Industrial Reconstruction to see that these factories are converted into plants for peace as soon as possible; therefore it is safe to assume, says Mr. Williams, that the factories will receive every opportunity to make reconstruction goods. So pressing is this need that machinery, in the partially destroyed and other parts of France, that would be ordinarily scrapped, with the buying of complete new plants, will be repaired as quickly as possible and put into commission.

Supplies Needed by France

Hence a call will be made for such supplies as France does not produce, including machinery packing, greases, leather belting, and other things needed to put machinery into commission as soon as possible. There will also be a demand for railway supplies and specialties, small tools, some farm implements and semi-steel products. As the new Ministry of Reconstruction takes hold and starts the various factories to work there will undoubtedly be an impetus in the demand, but Mr. Williams warns against assuming that when this demand arrives the big reconstruction era, the time to rush large supplies and solicit contracts for the work, has come.

He says, furthermore, that even if, on account of the record made by the American forces in France and the large amount of construction machinery already there, the French officials might let contracts in the United States, the American contractors would experience great difficulties in carrying out their contracts. Not the least of these difficulties, says Mr. Wil-

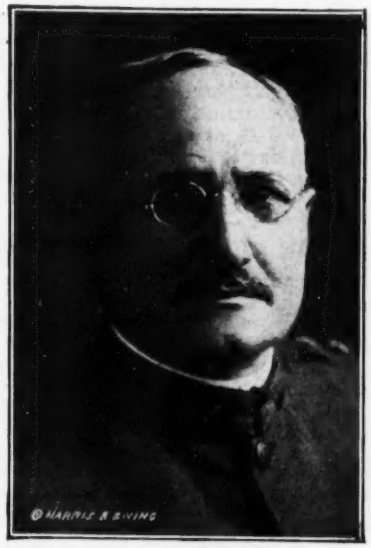
liams, will be the small French contractor, who will demand a share of the work and, when obtained, will do it, or wish to do it, in his own way and not the ways of the American contractor.

Credit, however, says Mr. Williams, is the predominating factor of the whole situation, and many of the bankers of this country and France state that it presents the most serious problem. After the signing of peace there will be no Government credit, and the formation of commercial credit will be a slow process. As has already been pointed out, the reconstruction period will be fully two years long, and probably more. It will be impossible for the French people to pay their debts until they can produce enough goods to sell. Take, as an example, a steel man who wishes to place an order for, say, $200,000 worth of machinery or equipment. It will be impossible for him to pay for this material until his steel works are bringing in a return. This will vary from two to two and a half years, and no business house in this country will be able to assume such long-time paper. It will be necessary, then, for this steel man to offer notes that will be guaranteed by the French Government, but such long-term notes will not conform to the rules of the Federal Reserve system in this country. One of the ways, then, that might be used to finance this trade would be the formation of a syndicate in this country which would take over these notes and issue bonds of their own, meanwhile holding the French notes. On the surface, this seems to be a simple process, but the bankers point out that the social unrest and Bolshevism now threatening all the countries of Europe, and the more attractive financial possibilities elsewhere in the world, will make American financiers very slow to take up such proposals.

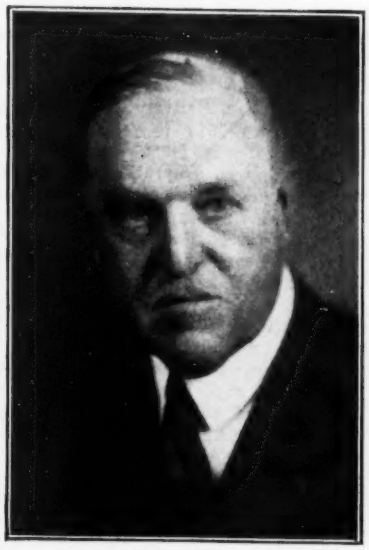
MUST SUPPLEMENT FRENCH EFFORTS

Concluding, Mr. Williams says: "America's part in the reconstruction of devastated France therefore will be to supplement French efforts. It will be necessary for us to supply French factories with only such raw materials as are not produced in France, and we shall doubtless be called upon to fill in certain gaps which at present exist in French industries. There are, or will be, many kinds of equipment which the French manufacturer will probably find it more economical to have made elsewhere, since it will be difficult for him to make them in his own plants, which for more than four years have specialized in the production of something very different. If American manufacturers can demonstrate to the French industrialists the advantage of having certain machines or parts of machines made in the United States, while the French concentrate on things for which their industries are especially adapted, a business alliance permanently beneficial to both nations will result. It is highly necessary, then, for the people of the United States to have great patience in the situation in France. At present, the business is not there, and until it develops the American manufacturer, engineer, and contractor must gather the facts bearing on the French problem and concentrate on the creation of an effective export, selling, or construction organization, in anticipation of the call which France may ultimately make upon our coöperation."

Engineers Decorated with Distinguished Service Cross



MAJ. GEN. WILLIAM S. SIBERT
Director of Chemical Warfare Service



MAJ. GEN. S. M. FELTON
Director General of Military Railroads

Government Will Sell Large Amount of Equipment

Ten million dollars' worth of equipment owned by the United Spruce Production Corporation is to be sold. Sealed bids will be received by the sales board appointed by Brigadier General Brice P. Disque, commanding officer.

The equipment, which consists of everything from picks and shovels to complete railroads and mills, capable of producing stock from the huge tree in the forest, to the finished product ready for shipment to the airplane factory, is in excellent condition and much of it, because of the abrupt ending of the war, was never used.

The corporation believes this to be an opportune time for the sale, on account of the reconstruction and adjustment, during which many large projects will probably be put under way very soon. This will require a large amount of machinery and equipment such as is to be sold, and will enable its absorption with the least possible disturbance of the markets and to the best advantage to the Government and the trade.

The equipment has been stored at Vancouver, Wash., where it may be inspected by interested persons, upon proper certification by the board, in the Yeon Building at Portland, Ore. Bids will be received at the same address up to and including Feb. 15.

Highway Traffic Association To Discuss Truck Regulation

A conference on regulations covering the speed, weight and dimensions of motor trucks will be held under the auspices of the National Highway Traffic Association at the Automobile Club of America, 247 West 54th St., New York City, at 8 p.m., Jan. 31. The discussion will be opened by the members of the Committee on Motor-Truck Regulations, which is composed of prominent men from all parts of the country. It is requested that highway officials, engineers, manufacturers and owners of motor trucks present their views freely, and thus aid in the solution of a problem which vitally affects the development of highways and motor transportation.

Testing Materials Society Joins Engineering Council

The American Society for Testing Materials has accepted an invitation to become a member of the Engineering Council.

All necessary formalities having been completed, this society is now in full membership, and its representative is expected to take his place at the annual meeting of the Engineering Council Feb. 20.

The present member societies of the Engineering Council are now the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Society for Testing Materials and the United Engineering Society.

Russian Railway Corps Still in Siberia

Awaiting Military Guards and Necessary Labor to Make Possible Any Progress in Work

The Russian Railway Service Corps, organized in 1917 to rehabilitate the Russian railway from Vladivostok to Petrograd, met from the outset with obstacles which prevented any headway being made in the direction intended. Upon arrival at Vladivostok the members of the corps were not permitted to land, the Bolsheviki having taken possession of the city. Some of the members went to Nagasaki, where they remained until about three months ago, at which time they managed to get into Manchuria and Siberia. There are about 200 of the corps awaiting developments there. They have been denied military guards and the labor with which to carry on the work, two conditions which make going ahead impossible.

Capt. J. D. Rogers, who returned to this country last June, stated that on the docks at Vladivostok there were about 500,000 tons of material held for months awaiting transportation facilities. He said that from Vladivostok to Petrograd the roadway, bridges and tunnels were in comparatively good condition, and that American engineers could, without difficulty, bring the railroad to a good working basis in a short time for the whole 6000 miles of track.

The corps was developed under the direction of S. M. Felton, director of military railroads, and is in charge of Col. George Harrington Emerson, former general manager of the Great Northern R.R. In an interview with the Washington representative of *Engineering News-Record* Mr. Felton said that the corps had been the victim of difficult circumstances and had therefore been unable to accomplish anything substantial, and that the length of the stay of its members in Russia is problematical. They will probably remain indefinitely. All expense of maintaining the corps is assumed by the Russian Government.

Government Will Dispose of Surplus Lumber Stocks

The second conference of the Government bureaus which have surplus building material to dispose of was called Jan. 20 by Richard L. Humphrey, director of building materials of the War Industries Board. At this meeting it was announced that all building-material industries had signified their approval of the plan of procedure that was outlined at the conference on Jan. 8, which was noted in *Engineering News-Record* of Jan. 23, p. 205. At this second conference the main subject discussed was lumber.

The Government surplus lumber stock will be purchased by various lumber interests in various parts of the United States at market prices, less a reasonable amount to pay for handling. The contract which was made will apply to lumber at any given point in amounts of 2,000,000 ft. and more. The purchase is to be completed on or before Aug. 1, 1919, with a further option to purchase lumber, as offered to the Government, in amounts less than 2,000,000 ft. at any given point on or before May 1, 1919. The conference announced that the surplus stock probably will not exceed 150,000,000 feet.

Committee Appointed To Study Automatic Train Control

The creation of the Automatic Train Control Committee of the United States Railroad Administration was announced Jan. 14 by C. R. Gray, director of the Division of Operation, as follows:

C. A. Morse, chairman; W. P. Borland, C. E. Denney, H. S. Balliett, Henry Bartlett, J. H. Gumbes, R. W. Bell.

The committee will make a study of the automatic train-control devices now undergoing test upon various lines of railroad or available for test, and report recommendations for the installation and further practical test of devices made available for that purpose, which they may consider practicable and reasonably conforming to the purposes to be accomplished. Their conclusions upon the mechanical or economic features of such of the devices as they may find available for practical use are also to be reported.

Government of Manitoba Appoints Drainage Commission

The Manitoba Government has appointed a drainage commission to investigate the problems of reclaiming by drainage large areas of land. The commission consists of J. G. Sullivan, chairman, formerly chief engineer, Canadian Pacific Ry., Harry Grills, of Sanford, and John A. Thompson, of Winnipeg.

Cornell Engineering Schools May Merge

At a dinner for the engineer graduates of Cornell University held in New York Jan. 17 announcement was made by President Schurman of the university that a committee of the board of trustees was considering a proposal to merge the College of Civil Engineering and Sibley College, in which mechanical, marine and electrical engineering is now taught. The schme—which in all likelihood will go into effect within a year, or perhaps two—contemplates one college of engineering in which all branches of engineering will be taught. President Schurman, Dean Haskell of the College of Civil Engineering, and Dean Smith of Sibley College, all enthusiastically advocated the merger.

Over 425 Cornell engineers were in attendance, the program including remarks by returned Army and Navy officers.

Under-River Water Conduit Contract To Be Relet

The contract for duplicating the Jersey City water-supply conduits where they cross under the Hackensack and Passaic Rivers was declared defaulted by the authorities of the city in December. Slightly amended specifications were adopted by the City Commission on Jan. 23, and invitation for bids was ordered. Michael I. Fagen is director of the Department of Streets and Public Improvements.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN ROAD BUILDERS' ASSOCIATION; 150 Nassau St., New York City; Feb. 25-28, New York City.

AMERICAN INSTITUTE OF MINING ENGINEERS; 29 West 39th St., New York City; Feb. 17-20, New York.

The North Carolina Society of Civil Engineers will hold its first annual meeting at Raleigh Feb. 8. A prominent place in the program will be given to a discussion of the social status of the engineer and to consideration of state legislation regarding the licensing of engineers. Affiliation with national societies will also be discussed. Among the papers to be presented are "Coöperation Among Engineers," by H. W. Keuffner; "The Social Status of the Engineer and How It May Be Improved," by Dr. W. C. Riddick; "Importance of Testing Materials for Construction," by Ira B. Mullis, and "Bridge Engineering and Its Future," by W. L. Craven.

The Engineers' Club of Philadelphia will hold a regular meeting Feb. 18. Maj. Nevil Monroe Hopkins, Technical Research Branch, Ordnance Department, U. S. A., previously of George Washington University, will present a paper, illustrated with lantern slides, on "The Spirit and Outlook for Research and Invention," with reference to Germany's methods of fostering research, in the past, as compared with those of this country. A special meeting of the club will be held Feb. 15, at which H. F. Moore, professor of experimental engineering, University of Illinois, will read a paper on "The Fatigue of Metals," illustrated with lantern slides and motion pictures. At the weekly luncheon Feb. 4 the club will be addressed by William S. Twining, director of the Department of City Transit, Philadelphia, on "Financing City Improvements."

The **Topeka Engineers' Club** held its first meeting Jan. 25. The officers of the club are: President, J. E. Williams, county engineer, Shawnee County; secretary, L. B. Smith, chief engineer, Topeka Bridge Co., and treasurer, H. S. Putney, president of the Road Supply and Metal Company.

The **New Jersey State Association of County Engineers** held its annual meet- at Trenton, Jan. 21. The state-aid specifications, the result of a year's study and research by members of the association, to be recommended to the State Highway Commission, were approved. The following officers were elected for the year: President, Garwood Ferguson, Passaic County; vice-president, Thomas J. Wasser, Hudson County; secretary, Alexander H. Nelson, Atlantic County, and treasurer, Alvin B. Fox, Middlesex County.

The **Kansas Engineering Society** will be addressed by Lieut. K. P. Cecil on "With the Artillery at the Front," and by Capt. L. R. Tillotson, on "With the Engineers in France," at the annual meeting to be held at Topeka Jan. 30-31, noted in these columns last week. Among the other subjects to be discussed are: "New Methods in Engineering Education," "Geological Engineering in Kansas," and "Some Highway Troubles, Their Cause and Cures," by S. E. Fitch, New York State Highway Department. Papers will also be read on concrete, brick and bitumen roads.

The **Illinois Association of Members of the American Society of Civil Engineers** Jan 20 elected the following officers: Maj. H. J. Burt, president, and Charles B. Burdick, vice-president. A brief discussion on the work of the development committee was entered into by the 25 members present. Edgar S. Nethercut is secretary-treasurer.

The **North Dakota Society of Engineers** will be addressed by W. B. Stevenson of Fargo on "The Relation of the Engineer to Reconstruction Work," at the annual meeting to be held at Valley City, Jan. 30-31, mentioned in these columns last week. On the first day of the meeting a report of the committee on legislation will be presented. Other committee reports include those on roads, bridges and drainage. On the second day of the meeting inspection trips will be made to the Valley City light plant and water-works and to the Northern Pacific high bridge. The papers to be presented before the meeting include the following: "Range Spotting by Aëroplane," by L. B. Dale; "Members of the Society in the War," by E. F. Chandler.

The **Montreal Branch of the Engineering Institute of Canada** will hold a meeting Feb. 6 at which the following papers will be read: "Some Problems in Ocean Transportation," by A. W. Robinson, and "Manufacture of Nitro-Benzol and Aniline Oils," by G. J. Caron.

The **Engineers' and Architects' Association of Southern California** held a meeting Jan. 31 at which Dr. Albert L. Shiels, superintendent of the Los Angeles schools, spoke on Bolshevism. At a second session of the meeting Leroy C. Bishop gave a talk on the use of the acousticon and the dictograph.

The **Albany Society of Civil Engineers** held a meeting Jan. 28, and was addressed by Dr. A. T. Lincoln, professor of chemistry, Rensselaer Polytechnic Institute, on "Service of Chemistry in the War," with particular reference to explosives and gas warfare.

The **Oregon Society of Engineers** will hold its annual meeting at Portland, Feb. 3.

The **Chicago Chapter of the American Association of Engineers** elected the following officers, at the recent annual meeting: President, Paul Augustinus; vice-presidents, A. M. Van Auken, William J. Strong, Robert W. Shelmire and L. O. Wolf; secretary, Walter M. De Berard, and treasurer, L. G. Reed.

The **Detroit Engineering Society** was addressed Jan. 24 by Lieut.-Col. G. M. Barnes, Ordnance Department, U. S. A., who spoke on "Long-Range Artillery in War." Colonel Barnes' paper included special reference to railway artillery and was illustrated with stereopticon views.

The **Rochester Engineering Society** will meet Jan. 31 and will be addressed by Virgil M. Palmer and F. A. Collins, Jr., who will speak on "Fatigue Study," with reference to the factory worker.

PERSONAL NOTES

Readers who are returning to civil life from military, naval or other Government service are strongly urged to send in items about themselves and about their friends who are in similar situation. Items should give former position, describe character of military or other service and state the civil work to which the engineer or contractor in question is going. In the case of those with service abroad, information regarding the activities of the units to which they were assigned is especially desired.

JOHN H. GREGORY, consulting engineer, New York City, has been appointed professor of sanitary engineering, Johns Hopkins University, Baltimore, succeeding Capt. Grandville R. Jones, Sanitary Corps, U. S. A., who recently died in the service. Professor Gregory has been engaged in consulting engineering practice in New York City for several years, specializing in water-supply work. After his graduation from the Massachusetts Institute of Technology in 1895 he entered the service of the Metropolitan Water Board of Boston as office assistant, engaged in the design of the Wachusett aqueduct. Later, for several years he was associated with Allen Hazen on various water-supply projects. In 1902 he became division engineer for the Jersey City Water Supply Co. on the 50,000,000-gal. daily water supply, in charge of the construction of the conduit from Boonton to Jersey City. In 1903 he became principal assistant engineer for the Commission on Additional Water Supply for New York City. In 1910 he was appointed engineer for the Metropolitan Sewerage Commission of New York. Several years later he became associated with Rudolph Hering, under the firm name of Hering & Gregory, consulting engineers, New York City, which firm was dissolved in 1917.

JOHN F. STEVENS, head of the American Railway Commission to Russia, is to become chief administrator of the Transsiberian Ry., from Porgranichana to Omsk, a distance of 3000 miles, with General Horvath as co-director, according to recent dispatches from Vladivostok concerning the allied control of the Transsiberian line.

E. LOGAN HILL, secretary of the United States Shipping Board Commission on Port and Harbor Facilities, resigned recently to become associated with Heyl & Patterson, Inc., contracting engineers, Pittsburgh. Previous to his appointment to the Shipping Board Mr. Hill was assistant general manager of the Erie R. R. He will be attached to the New York office of the company, and will specialize in freight-handling problems.

MAJ. EUGENE W. STERN, Engineers, U. S. A., who was superintendent of roads in Base Section 2, with headquarters at Bordeaux, American Expeditionary Forces, has returned to the United States and has been discharged from the Army. He is at his home in New York City, where he was formerly chief of the Bureau of Highways, Borough of Manhattan. In his military service, Major Stern had charge of the construction and maintenance of roads near Bordeaux, and in that capacity built 35 miles of new road, resurfaced 45 miles, and maintained 100 miles. This work involved the handling of something like 100,000 tons of road stone, part of which was

produced under Major Stern's supervision.

A. H. KROM, director of the Division of Engineering, United States Employment Service, Chicago, has returned to the American Association of Engineers as assistant secretary. Since the division was organized in July, more than 5000 engineers have been placed in positions.

LIEUT. COL. H. W. HODGE, Engineers, U. S. A., recently returned from overseas, has received his discharge from the service and has returned to his office in New York City.

W. WALKER, acting division engineer, Grand Trunk Ry., Eastern Lines, has been appointed division engineer, succeeding Maj. F. C. L. Bond, promoted to be chief engineer of the system, with headquarters at Montreal, as noted in *Engineering News-Record* of Dec. 26, p. 1202.

LIEUT. COL. SANFORD E. THOMPSON, Ordnance Department, U. S. A., who has been in charge of the Estimates and Requirements Division of the Ordnance Department in Washington, has been discharged from the Army and has returned to Boston to resume his consulting practice.

CAPT. E. E. HOWARD, Engineers, U. S. A., who was commissioned last October, has received his discharge from the service and returned to his work with the firm of Harrington, Howard & Ash, consulting engineers, Kansas City, Mo.

WARREN WORTHINGTON, general superintendent, in charge of engineering and erection, Donner Steel Co., Buffalo, N. Y., has resigned to become special engineer in charge of steel-mill construction and equipment for the American Steel Export Co., New York City.

CAPT. WARD S. ROBINSON, recently discharged from the Personnel Branch, Office of Procurement Section, Operations Division, General Staff, formerly with the Illinois State Civil Service Commission, has been made head of the Middle West zone of the Division of Engineering, United States Employment Service.

GEORGE W. OSGOOD has been appointed engineer of the Tacoma, Wash., Port Commission, of which Frank J. Walsh has been appointed consulting engineer, as noted in these columns last week.

H. N. RODENBAUGH has been appointed engineering assistant to the Regional Director, Southern Region, United States Railroad Administration.

CAPT. H. C. MCCORMACK, Engineers, U. S. A., has received his discharge from the service and returned to the Koppers Co., Pittsburgh.

M. O. LEIGHTON, consulting engineer, Washington, D. C., who has been chosen as chairman of the newly formed National Service Committee of the Engineering Council, mentioned last week, p. 206, has made a particular study of hydro-electric development in this country. He testified before the Congressional committee on the possible commercial development of navigable rivers and streams in forest preserves,

Chairman of National Service Committee

M. O. LEIGHTON

indicating also to what extent canalization of navigable streams would result in improvements to navigation as well as in water-power possibilities. He has made a study of the application of water-power to many uses, including industry, central stations, and electrochemistry and especially to railroad electrification. Mr. Leighton was born in 1874 and was graduated from the Massachusetts Institute of Technology in 1896. He engaged chiefly in hydraulic work, and in 1906 was appointed chief hydrographer of the Geological Survey. He continued in this office until 1913, when he took up consulting work. He has been a member of a number of Government commissions to study waterways.

BRIG. GEN. AMOS A. FRIES, Engineers, U. S. A., who was in charge of the Chemical Warfare Service of the American Expeditionary Forces, has returned to the United States and is now assigned to duties in Washington, D. C.

F. E. BONNER, assistant engineer, Forest Service, Washington, D. C., has been appointed acting district engineer for the Forest Service at Denver, Colo.

MAJ. WILLIAM M. ACHESON, Engineers, U. S. A., who was superintendent of roads for the American Expeditionary Forces, has returned to the United States and, since his discharge from the Army, has returned to his home in Syracuse, N. Y. He was formerly division engineer of the New York State Highway Department, at Syracuse.

D. C. NEWMAN COLLINS, engineer and architect, until recently associated with the Emergency Fleet Corporation, has returned to his office at 14 John St., New York City.

ARTHUR BONIFACE, JACOB SIEBERT and WALTER H. FEDERLEIN have become associated under the firm name of the Boniface Construction Co., engineers and contractors, with office at 52 Vanderbilt Ave., New York City.

FRANK W. WARD, formerly of Ridgville, Penn., has become city engineer of Niles, Ohio, succeeding H. W. Turner, resigned.

OBITUARY

LT. COL. HOWARD L. BODWELL, D. S. O., C. M. G., Croix de Guerre, assistant director of light railways, Canadian Military Area, France, died at St. John, N. B., a few days after his arrival from France. He was a graduate of the Royal Military College, Kingston, and had been connected with railway engineering in western Canada. He had also served two years in China on railroad work. At the outbreak of the war he went overseas as second in command of the Canadian Battalion, and subsequently won the decorations noted above.

COL. ROBERT S. LOW, of the contracting firm of Bate & McMahon, Ottawa, Ont., died Jan. 16. He had been engaged in war construction work, including the construction of Valcartier Camp and Camp Borden, and was afterward engaged in reconstruction work at Halifax.

JONAS F. YOUNG, locating engineer, Lehigh & New England R.R., died recently in Buffalo. He was born in 1847, and was graduated from Rensselaer Polytechnic Institute, Troy, N. Y., in 1868, taking the degree of C. E. in 1872. His first railroad work was for the Buffalo, Rochester & Pittsburgh. He afterwards became associated with the Lehigh Valley R.R., for which he served as division engineer for several years. Later he became division engineer, Chicago, Milwaukee & St. Paul Ry., on double-track work in Iowa.

MORLEY L. SMITH, director of engineering of the Technical School, Toronto, died Jan. 18, at the age of 37. He was graduated from Toronto University in electrical engineering in 1912.

Bridge Builders Report 27 Per Cent of Capacity Taken

The records of the Bridge Builders' and Structural Society, as collected by its secretary, show that during December, 1918, 29% of the entire capacity of the bridge and structural shops of the country was contracted for. During the entire year 1918 the new business placed amounted to 56% of capacity.

New Light-Weight Shovel That Can Be Converted Into Crane

In order to meet the wider range of usefulness that, according to manufacturers, will be demanded of construction machinery, a light portable steam shovel has been produced. It may also be converted into a crane, with a working radius of 25 ft. and able to handle a ½-yard clamshell bucket, by adding an auxiliary shaft carrying two drums, and the substitution of a longer and lighter boom.

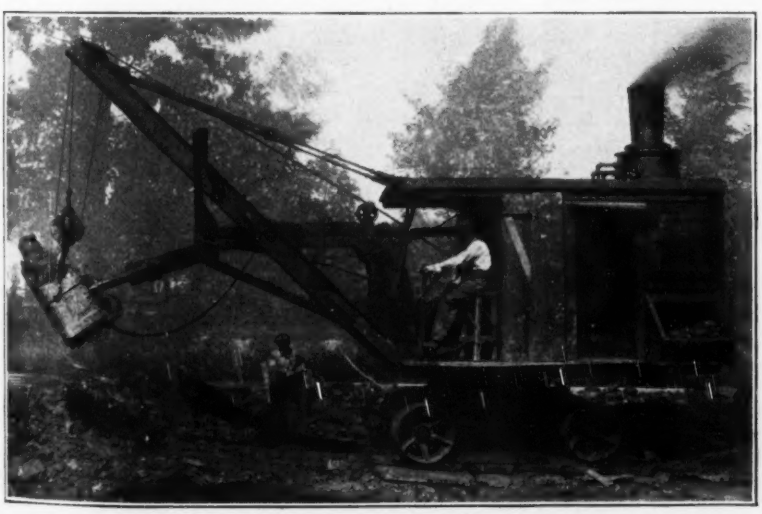
It is so designed that, with minor changes, it may be equipped for steam, electric or gasoline operation and the change from one form of power to another can readily be made in the field, at reasonable expense.

When equipped for electric or gasoline motor, this auxiliary shaft controls the dipper crowding motion, so that the only change from shovel to crane lies in the exchange of booms. All drums are power-driven, and the machine is adapted to clamshell or drag-scraper service.

Independent double reversing engines are employed for hoisting, crowding and swinging when the power is steam, and for electric and gasoline service a single motor is used, operating at constant speeds. The various motions are controlled through reversing frictions.

When equipped as a shovel the machine is regularly mounted upon a truck with wide-tired traction wheels, with both hand and power steer. It is self-propelling at speeds approximating 1½ miles per hour, and is designed primarily for the lighter classes of work to be undertaken by a shovel of this size. It weighs 14 tons and regularly uses a ½-yd. dipper. It has handled clay, earth or thoroughly blasted material at a rate of approximately 300 cu.yd. per day.

The shovel is manufactured by the Thew Automatic Shovel Co., Lorain, Ohio.



STEAM SHOVEL MAY BE FITTED GASOLINE OR ELECTRIC POWER

National Builders' Supply Association Elects Officers

At a convention held last week in Indianapolis, Ind., the National Builders' Association elected officers for the ensuing year. Arthur E. Bradshaw, of the Indianapolis Mortar and Fuel Co., was elected president; Charles M. Kelly, of Providence, R. I., vice-president, and John J. Voelkel, of New Orleans, La., treasurer. A board of directors to serve two years was also appointed.

Following the decision of the executive committee, the convention was conducted wholly as a business session, with discussions of questions of vital interest to the association. A resolution was passed and forwarded to Washington urging the Federal Government, through its proper departments, to make a speedy investigation, and an announcement, regarding the stability of the present market valuations, with the object of creating confidence in the industries represented by the association. The latter are being held back by statements regarding the possibility of an early decline in present valuations. These statements the members believe to be misleading.

Total 1918 Foreign Trade but Slightly Below That of 1917

Heavy December shipments brought the total exports for 1918 to $6,150,000,000, a decrease of but $83,000,000 from the 1917 total, according to an announcement by the Bureau of Foreign and Domestic Commerce. Imports for the year totaled $3,031,000,000. Imports for the previous year were $2,952,000,000.

Exports for December, the first full month after the signing of the armistice, reached a total of $566,000,000, a decided increase over the $522,000,000 recorded for November, although not up to the high mark of $600,000,000 for December, 1917.

Imports for December, however, at $211,000,000, were low as against $251,000,000 for November and $228,000,000 for the month of December of the previous year.

Business Notes

The Superior Portland Cement Co., Seattle, has purchased the plant of the Washington Portland Cement Co. at Concrete, Wash., adjoining the Superior plant. John C. Eden becomes president of both concerns.

Francis C. Bagby has succeeded J. F. Weiss as district manager for the Kansas City district of the Corrugated Bar Co., with offices at 1505 Waldheim Bldg. Mr. Bagby, who is a member of the American Society of Civil Engineers, was formerly manager of the St. Louis and Detroit offices of his company.

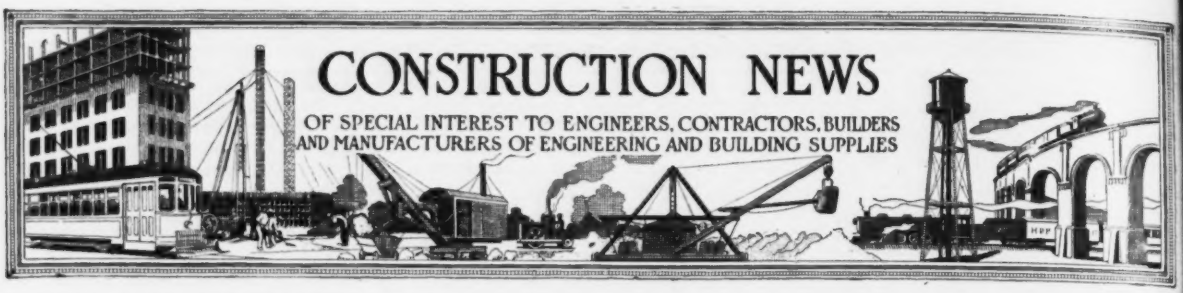
W. W. Cochrane, formerly in the purchasing department of the Chain Belt Co., Milwaukee, Wis., has been appointed manager of excavator sales by the Pawling & Harnischfeger Co., Milwaukee, Wis.

Trade Publications

"The Road to Peace" is the title of a recent 42-p. 11 x 14 book, in pamphlet form, showing in full-page half tones, pictures of war work in which the products of the Lakewood Engineering Co., Cleveland, Ohio, were used.

The McKenna Co., 1851 E. 38th St., Cleveland, Ohio, has issued Catalogue A, describing its bar-bending machines. It illustrates and describes five types of power bending machines, one hand bending machine, stirrup formers and steel shears, all of which are used in the handling of reinforced-concrete steel.

Drill sharpeners and stationary and portable air compressors of various types are the subject of four bulletins, 6 x 9 in., issued by the Sullivan Machinery Co., Chicago, as follows: Drill sharpeners, 24 pp.; simple straight-line compressor, 12 pp.; simple compressor with two-stage air cylinders, 12 pp.; small belt-driven compressors, 12 pp.; portable mine-car compressors and "rotator" hammer drills, eight pages.


CONSTRUCTION NEWS
OF SPECIAL INTEREST TO ENGINEERS, CONTRACTORS, BUILDERS
AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES

PROPOSALS

For Proposals Advertised See Pages 47a to 49 inclusive

WATER-WORKS

Bids Close		See Eng. News-Record
Feb. 3	Cascade, Mont.	Jan. 30
Feb. 3	Kingfisher, Okla.	Jan. 30
Feb. 3	Maple Heights, O.	Jan. 16
Feb. 11	Poughkeepsie, N. Y.	Jan. 30
Feb. 18	Jersey City, N. J. Adv. Jan. 30.	Jan. 30
Feb. 25	East Chicago, Ind. Adv. Jan. 30.	Jan. 30
Feb. 28	Clarksburg, W. Va. Adv. Jan. 30.	Jan. 30

SEWERS

Feb. 3	Ford (Wyandotte P. O.) Mich.	Jan. 30
Feb. 5	Appleton, Wis.	Jan. 30
Feb. 5	Portvue, Pa. Adv. Jan. 16, 23 and 30.	Jan. 16
Feb. 8	Granite City, Ill.	Jan. 23
Feb. 25	St. Louis, Mo.	Jan. 30

BRIDGES

Feb. 3	Charlotte Harbor, Fla. Adv. Dec. 19, 26, Jan. 2 and 9.	Jan. 2
Feb. 3	Oswego, Kan.	Jan. 30
Feb. 6	David City, Neb.	Jan. 30
Feb. 11	Oglethorpe, Ga.	Jan. 30

STREETS AND ROADS

Feb. 1	Atlanta, Ga.	Jan. 30
Feb. 3	Clarksdale, Miss.	Jan. 30
Feb. 3	San Antonio, Tex.	Jan. 30
Feb. 3	Santa Barbara, Cal.	Jan. 23
Feb. 3	Indiana	Jan. 23
Feb. 3	Wichita, Kan.	Jan. 9
Feb. 4	Indiana	Jan. 23
Feb. 5	Indiana	Jan. 23
Feb. 5	Hartville, Mo.	Jan. 23
Feb. 5	Indiana	Jan. 9
Feb. 5	Grand Island, Neb.	Jan. 30
Feb. 7	Norton, Kan.	Jan. 23
Feb. 10	Fayetteville, W. Va.	Jan. 16
Feb. 10	Idaho	Jan. 30
Feb. 11	Indiana	Jan. 23
Feb. 11	Moulton, Ala.	Jan. 16
Feb. 14	Oswego, Kan.	Jan. 30
Feb. 17	Philippi, W. Va. Adv. Jan. 23.	Jan. 23
Feb. 17	California	Jan. 30
Feb. 17	Tulsa, Okla.	Jan. 30
Feb. 18	Indiana	Jan. 23
Feb. 18	Albany, N. Y. Adv. Jan. 23.	Jan. 23
Feb. 20	Hamlin, W. Va.	Jan. 23
Feb. 20	Rumson, N. J. Adv. Jan. 23.	Jan. 23
Feb. 24	Middlebourne, W. Va. Adv. Jan. 30.	Jan. 30
Mar. 4	Ripley, W. Va.	Jan. 23

EXCAVATION AND DREDGING

Feb. 3	Madisonville, Ky. Adv. Dec. 5, 12 and 19.	Dec. 12
Feb. 3	Lewiston, Ill.	Jan. 30
Feb. 10	St. James, Minn.	Jan. 30
Feb. 15	SouthBend, Ind.	Jan. 30
Feb. 18	Albany, N. Y. Adv. Jan. 23.	Jan. 23
Feb. 19	Albany, N. Y. Adv. Jan. 23.	Jan. 23

INDUSTRIAL WORKS

Bids Close		See Eng. News-Record
Feb. 3	New York, N. Y.	Jan. 30
Feb. 3	New York, N. Y.	Jan. 23
Feb. 18	Albany, N. Y. Adv. Jan. 23.	Jan. 23
Feb. 25	New York, N. Y.	Jan. 30
Mar. 4	Thiells, N. Y.	Jan. 16
Apr. 1	Sioux City, Ia.	Jan. 16

BUILDINGS

Feb. 1	Irvington, N. J.	Jan. 23
Feb. 3	Melbourne, Fla.	Jan. 9
Feb. 3	St. Paul, Minn.	Oct. 31
Feb. 3	Leavenworth, Kan.	Jan. 23
Feb. 5	Portland, Mich.	Jan. 23
Feb. 5	Washington, D. C.	Jan. 30
Feb. 6	New York, N. Y.	Jan. 30
Feb. 10	New York, N. Y.	Jan. 30
Feb. 11	Lusk, Wyo.	Jan. 23
Feb. 14	Brooklyn, N. Y.	Jan. 23
Feb. 19	Brooklyn, N. Y.	Jan. 30
Feb. 21	Phillipsburg, O.	Jan. 30
Feb. 24	Norwood, O.	Jan. 23
Feb. 24	Cincinnati, O.	Jan. 30
Mar. 1	Cloquet, Minn.	Jan. 30
Mar. 1	Mountain Iron, Minn.	Jan. 30
Mar. 1	Duluth, Minn.	Jan. 23
Mar. 3	Rockport, Ind.	Jan. 23
Mar. 15	Culver, Ind.	Dec. 26
Apr. 2	New York, N. Y.	Jan. 23

FEDERAL GOVERNMENT WORK

Feb. 3	Dredging — Spec. 3579 — Ft. Lafayette, N. Y.	Jan. 16
Feb. 3	Kitchen Equipment—Spec. 3730—Chelsea, Mass.	Jan. 16
Feb. 3	Water Tower, Pump and Tank House Equipment—Spec. 3682 — Philadelphia, Pa.	Jan. 16
Feb. 3	Hangars, Pavement and Beach—Spec. 3432—Galveston, Tex.	Jan. 30
Feb. 4	Boilers—Memphis, Tenn. Adv. Jan. 9.	Jan. 9
Feb. 4	Turbine, Pump set, etc. — Memphis, Tenn. Adv. Jan. 9.	Jan. 9
Feb. 5	Tank and Tower—Ft. Mifflin, Pa.	Jan. 30
Feb. 10	—Metal and Glass—Baltimore, Md. — Adv. Jan. 16.	Jan. 16
Feb. 10	Portland Cement — Denver, Colo.	Jan. 23
Feb. 10	Refrigerating Plant Equipment—Spec. 3749—Ward's Island, N. Y.	Jan. 30
Feb. 10	Steel Stock and Storage Shed—Spec. 3736—Boston, Mass.	Jan. 30
Feb. 10	Laundry Equipment—Spec. 3665—Ward's Island, N. Y.	Jan. 30
Feb. 10	Chimney for Boiler Plant—Spec. 3606 — New York, N. Y.	Jan. 30
Feb. 10	Coal and Ash Handling Equipment — Spec. 3300—Hampton Roads, Va.	Jan. 30
Feb. 10	Tanks—Spec. 3628—Quantico, Va.	Jan. 30
Feb. 10	Coal and Ash Handling Equipment — Spec. 3607 — New York, N. Y.	Jan. 30
Feb. 11	Bridge—Washington, D. C. Adv. Jan. 16.	Jan. 16
Feb. 12	Elevator, etc. — Ft. Worth, Tex. Adv. Jan. 23.	Jan. 23
Feb. 15	Laboratory — Washington, D. C. Adv. Jan. 23.	Jan. 23
Feb. 17	Piping and Circulating System — Spec. 3416 — Portsmouth, N. H.	Jan. 30
Feb. 17	Small Boat Basin and Bulkhead—Spec. 3776—Indianhead, Md.	Jan. 30
Feb. 17	Railroad Extension—Spec. 3727—Ft. Mifflin, Pa.	Jan. 30
Feb. 17	Equipment, etc.—Spec. 3328 Hampton Roads, Va.	Jan. 30
Feb. 20	Surgical Dressing Room—St. Louis, Mo.	Jan. 30
Feb. 21	Dredging, etc. — Norfolk, Va. Adv. Jan. 23.	Jan. 23
Feb. 24	Fuel Oil Storage Plant—Spec. 3631—Mare Island (Vallejo P. O.)	Jan. 30
Feb. 25	Jetty Work—Sabine Pass, Tex. Adv. Jan. 23.	Jan. 23
Mar. 1	Foundation and Rip Rap—Baltimore, Md. Adv. Jan. 16.	Jan. 16
Mar. 1	Dredging—Superior, Wis.	Jan. 16
Mar. 3	Barracks — Spec. 3728 — Fire Island, N. Y.	Jan. 30

MISCELLANEOUS

Feb. 3	Crib—Casper, Wyo.	
Feb. 3	Dam—Los Angeles, Cal.	Jan. 9
Feb. 5	Chlorine, etc.—New York, N. Y.	Jan. 30
Feb. 11	Boilers and Piping, etc. — Utica, N. Y.	Jan. 23
Feb. 13	Refrigeration Equipment—Iroquis, N. Y.	Jan. 30
Feb. 13	Road Oil, Asphalt, etc., Montclair, N. J.	Jan. 30
Feb. 14	Additional Window Guards —Bedford Hills, N. Y. Adv. Jan. 23.	Jan. 23
Feb. 14	Pier—Philadelphia, Pa. Adv. Jan. 23.	Jan. 23
Feb. 19	Gantry Crane — Seattle, Wash. Adv. Jan. 2 and 9.	Jan. 2

Where name of official is not given, inquiries should be addressed to City Clerk, County Clerk or corresponding official.

Waterworks

PROPOSED WORK

N. Y., Central Islip—State Hospital Comm., Albany, applied to State Legislature, for appropriation of $25,000 for water supply at Central Islip State Hospital.

N. Y., Dannemora—State Prison Comm., Albany, applied to State Legislature for appropriation of $10,000 for new reservoir and extension of water supply system.

N. Y., Poughkeepsie—State Hospital Comm., Albany, applied to State Legislature, for appropriation of $30,000 to improve water supply at Hudson River State Hospital here.

N. J., Newark—City will sell $500,000 bonds Feb. 6 for water supply system in Wanaque River watershed and $300,000 bonds for extending water supply system in Pequannock River watershed. M. R. Sherrard, city engr.

W. Va., Elkins—City plans to install filtration system.

Fla., Ft. Lauderdale—City plans election to vote on $30,000 bonds for improvements and extensions to water system.

Wis., Milwaukee—City plans to drill artesian wells in various parts of city. About $50,000. G. Staal, city engr.

Minn., Manganese—City soon lets contract building water-works system. I. C. Dimmic, clk.

Minn., St. Paul—City plans to build stand pipe in Dale St. to increase water pressure About $10,000. O. Claussen, city engr